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RAOUL RAFFRAY

Le 9 Septembre 1947 le Corps Agricole fut douloureusement surpris d'apprendre la mort subite d'un de ses membres les plus distingués : Monsieur Raoul Raffray.

Né le 11 Juin 1875, Raoul Raffray, après de sérieuses études scolaires, commença dans la vie comme apprenti-mécanicien. De ces débuts modestes il devait conserver un goût particulier pour la mécanique. Aussi, poursuivit-il, malgré d'autres occupations, des études d'ingénieur par correspondance ; et les connaissances ainsi acquises lui furent par la suite d'une grande utilité dans son rôle d'administrateur général de bien sucrier, et l'aidèrent à mettre en valeur un esprit inventif qui devait le conduire à la réalisation d'un décortiqueur automatique d'aloès pour la production de fibres.

Reçu arpenteur-juré en Décembre 1895, Raoul Raffray fut appelé à tracer de nombreux réseaux de tramway pour les propriétés sucrières de l'Ile lorsque, par suite du surra, celles-ci se virent forcées d'avoir recours à la traction mécanique pour remplacer leurs bêtes de trait décimées par l'épidémie.

En 1906, Raoul Raffray s'associa, avec son cousin Albert de Maroussem, dans le bureau de courtier de son frère, Monsieur René Raffray ; et peu après acquit une part dans la propriété Anse Jonchée. Ayant réalisé celle-ci, lui et ses associés devinrent propriétaires de Standley et d'Ebène qui furent revendues en 1908. Ce furent ses débuts dans l'Industrie Sucrière. Mais le chef-d'œuvre de Raoul Raffray devait être la mise en valeur de la propriété Médine.

Un jour, en 1910, alors qu'il revenait d'une chasse à Yemen, et traversait la Rivière Noire en chemin de fer, son esprit d'observation toujours en éveil fut frappé par la topographie des lieux, et Raoul Raffray comprit tout le parti que l'on pourrait tirer de ces terres pour la plupart en friches, et conçut le rêve de faire de Médine une centrale importante.

En janvier 1911, sur ses conseils, les familles Raffray et Maroussem acquirent Médine du Crédit Foncier pour la somme de six cent mille Roupies. Cette propriété avait alors une superficie de 2,800 arpents et en cultivait 500, et en cette année 1911 réalisa une production (qui constituait un record) de 1,250 tonnes de sucre.

Raoul Raffray fut nommé administrateur général de la Compagnie, et le demeura jusqu'au début de 1947.

Grâce à son intelligence prévoyante, à son labeur méthodique et incessant, il sut transformer l'affaire dont les destinées lui avaient été confiées et en faire un de nos plus beaux biens sucriers En effet, l'étendue cultivée par cette Compagnie est maintenant quatre fois plus grande que celle de 1911 ; un système d'irrigation permet la mise en valeur de terres fertiles autrefois en friches ; son usine d'aloès de Beaux Songes permet à la Compagnie de fabriquer un important tonnage de fibre d'aloès ; sa distillerie est l'une des plus belles et des plus modernes de l'île ; la production sucrière de l'usine de cette compagnie a atteint 17,500 tonnes en 1941 ; tout ce magnifique résultat n'est que le fruit de la belle conception de Raoul Raffray et de ses efforts énergiques.

A la fin de ses jours il pouvait contempler son œuvre avec satisfaction. Toutefois il eût voulu mieux faire encore, et regrettait parfois que la brièveté de la vie ne lui permît d'accomplir des développements qu'en son cœur il souhaitait pour la Rivière Noire : " Il m'aurait fallu deux existences " disait-il avec une souriante mélancolie.

Raoul Raffray ne s'est pas contenté d'être un grand industriel, dont l'opinion faisait autorité tant en matières sucrières qu'en matière d'aloès et de tabac. Il fut aussi un érudit et un grand intellectuel qui s'intéressait aux lettres et aux arts. Ses rapports sur toutes les questions qu'il a eu à traiter dénotent l'écrivain né, et la publication récente d'un beau poème sur la France éprouvée ne fut pas pour surprendre ceux qui connaissent sa culture étendue, son cœur vibrant et d'une charité aussi discrète qu'inépuisable.

Il a donné aux siens et à son pays l'exemple d'une noble et belle vie.

Ses compatriotes qui le pleurent peuvent en être fiers.

NOTES ET COMMENTAIRES

La Revue Agricole souhaite la bienvenue à Messieurs J. H. Gorvin, C.B.E., C. H. Penning, et R. A. Ellefsen qui sont arrivés dans le courant du mois d'octobre pour siéger comme membres de la Commission Economique qui va enquêter sur l'industrie sucrière.

On est autorisé à penser que la récolte sucrière de la colonie dépassera cette année la production record de 1942 (328 tonnes, chiffres du Syndicat des Sucres). Ce record coïncidera comme en 1909 avec une enquête sur l'industrie sucrière. En effet, la production de 1909 (252,000 tonnes), année de la Commission Royale sur les affaires du pays, dépassa de 30,000 tonnes le chiffre de production le plus élevé, atteint en 1906.

Nous souhaitons la bienvenue à M. G. W. Lock O.B.E., Senior Agricultural Officer du Département d'Agriculture du Tanganyika où il est en charge de la station expérimentale du sisal à Ngomeni. Monsieur Lock rencontra les filateurs le 24 octobre et exposa ses vues sur les problèmes spécifiques de notre industrie textile. Nous espérons pouvoir publier un compte rendu de cette réunion dans la prochaine livraison de la Revue Agricole.

La Revue Agricole félicite M. P. R. Scott, C. Kœnig, P. J. S. Félix qui ont obtenus le diplôme de technologie sucrière de l'Institute de City and Guilds.

Au cours de l'assemblée du " British Association for the Advancement of Science ", tenue à la fin d'août dernier, le Dr W. G Ogg, directeur de l'Institut de Recherches de Rothamsted, et président de la section Agriculture disait : " It has been claimed that artificial fertilizers poison the soil and are injurious to the health of plants, animals and human beings. Most of those who hold these beliefs are quite unscientific in their outlook."

Le Dr J. L. Simonsen, président de la section de Chimie, parlant de la découverte de la paludirine par les docteurs Curd & Rose : " probably the greatest contribution of British Chemistry in the field of chemotherapy..... I believe life in the tropics will be revolutionary. "

Mr C. A. Oakley président de la section de psychologie : " A depressed area is one in which young people no longer have faith and can see no opportunity. "

THE MAURITIUS ECONOMIC COMMISSION

Three of the oversea members of the Commission appointed to examine and report on the economics of the local sugar industry arrived by Air France plane on Saturday, 11th October. They are Mr. J. H. Gorvin, Chairman, Mr. C. J. H. Penning, sugar engineer and Mr. R. A. Ellefsen, a member of the Home Civil Service who will act as Joint Secretary and Accountant.

Mr. Gorvin, whose service has been mainly with the Ministry of Agriculture, has also served on special missions in Jamaica, and Newfoundland, and during the war in the Foreign Office Relief Department and in UNRRA.

Mr. C. J. H. Penning, a Dutch national resident in England, has had life-long experience in the engineering side of the sugar industry. He reported in 1944 on the general condition of the sugar factories in Jamaica and more recently made a special visit to Mysore to act as adviser to the Mysore Sugar Company.

Mr. R. A. Ellefsen, who will act as Joint Secretary and Accountant is employed by the Home Office who have agreed to release him for the purpose of forming part of the Commission.

It is expected that a fourth oversea member of the Comission, Mr. R. R. Follett-Smith, will arrive in the Colony on 7th November, to advise on the agricultural side on the industry.

The terms of reference of the Commission are " Bearing in mind the supreme importance of the sugar industry in the economy of Mauritius, to study possible means of improving the organisation, processing, production and distribution methods of the industry ; to report on steps which could be taken in the interest of the country to strengthen it and render it more stable and more able to survive in competitive conditions, and to consider generally any consequential action which may be necessary in view of the effects of such measures on the general economy of the Colony or to supplement measures for the improvement of the Sugar Industry by strengthening other aspects of that economy ".

It must be emphasised that the Commission, which will be numerically a large one, is a combined working party of experts and of representatives of all branches of the Sugar Industry, acting together as a team, for the benefit of the Mauritius Industry as a whole and not for the interest of any one party.

The Combined Working Party will be known as the Mauritius Economic Commission because its terms of reference are wider than a consideration of the efficiency of the sugar industry alone. The Commission was appointed on 28th October, 1947 by H. E. the Officer Administering Government and consists of the following members :

J. H. Gorvin, Esquire, C.B.E. — The Hon. Abdool L. M. Osman
L. de Chazal, Esquire — C. J. H. Penning, Esquire M.A.S.M.E.
R. R. Follett Smith, Esquire — J. N. Roy, Esquire
F. Leclezio, Esquire — J. G. Rozemont, Esquire
The Hon. André L. Nairac

Dr. E. Millien, H. R. Vaghjee, Esquire, A. Wiehe, Esquire } Associate Members

R. A. Ellefsen, P. O. Wiehe } Joint Secretaries

BUD ROT OF THE ROYAL PALM IN MAURITIUS.

G. ORIAN

Assistant Plant Pathologist — Department of Agriculture,
Réduit — Mauritius.

Contents

Introduction.

Bud rot of palms first attracted attention as a destructive disease of the coconut plant in the West Indies, towards the end of the last century. In 1904, Dr. E. F. Smith of The United States Department of Agriculture (41), started the study of the disease in Cuba and in 1906 reached the opinion that it was bacterial in origin. Dr. J. R. Johnston (17) who continued Smith's investigations concluded that :

" *Bacillus coli* or an organism indistinguishable from it "

was the cause of the disease. *Bacillus coli* is a common inhabitant of the intestinal tract of man and many animals and its occasional presence in water or in the soil is supposed to indicate contamination from such sources. Various other workers also considered the disease to be caused by bacteria.

Whilst Smith was studying the disease in Cuba, E. J. Butler was engaged with a similar disease on the palmyra palm *Borassus flabellifer* L., the betel nut palm *Areca Catechu* L, and the coconut palm *Cocos nucifera* L., in India. In 1906, Butler announced that the disease he had been studying was caused by a fungus which he named *Pythium palmivorum*, a name which he changed to *Phytophthora palmivora* in 1919. Mycologists thus came to be divided in opinion as to the cause of the bud rot, one school holding that it was bacterial in origin, the other that it was of fungus nature and that the bacteria present were only secondary invaders.

The Phytophthora fungus was also found causing a bud rot of the coconut in the Philippines by O. A. Reinking in 1918 (32), and in Jamaica by S. F. Ashby, also in the same year (2).

Further studies indicated however that the problem was more complex. Thus Nowell in Trinidad in 1909 (22) found that many of the so-called cases of bud rot of coconut in the island were really a different disease, which he called the " red ring " disease, and caused by the nematode worm *Aphelenchus cocophilus* Cobb.

At the Imperial Botanical Conference held in London in 1924 (15), the coconut bud rot problem was discussed in the light of the observations made up to then, and it was understood that it was in many cases still of obscure nature. Butler on that occasion even expressed doubt as to whether there was any such thing as a primary bacterial bud rot of palms (7).

In a recent book written by H. R. Briton-Jones (5) and published in 1940 after his death, coconut bud rot was subdivided into the following separate diseases: (a) Bronze leaf wilt, (b) Phytophthora bud rot, (c) Taper-

ing stem wilt or Pencil point, and (d) Red ring disease ; and the writer stated :

" it will be noticed that this list does not include any disease which is ascribed to bacteria ".

In 1934, E.F.S. Shepherd (39) announced the existence of an infectious type of top rot on the white palm (*Dictyosperma album* Wendl. & Drude) in Mauritius and stated that the disease was being studied by the present writer, then Scientific Assistant of the Department of Agriculture.

In 1937 and 1938 (25, 26, 28, 29), the writer announced that he had identified the Dictyosperma pathogen as *Bacterium vasculorum* (Cobb) Grieg-Smith, the cause of the well known gummiug disease of the sugar cane. In the present work he will bring forward proof that the bud rot of the royal palm (*Roystonea regia* O. F. Cook) in the island, is also caused by the same organism, now referred to as *Xanthomonas vasculorum* (Cobb) Dowson.

2 — The royal palm introduced into Mauritius.

The writer has not been able to trace the exact date of introduction of the royal palm in the island, but the following extract from a handbook on the Botanical Gardens in Mauritius (11), published in 1924 under the directorship of Dr. H. A. Tempany, gives an indication of the time at which the introduction was made :

".....Mr. J. Duncan was appointed Director (*of the Royal Botonical Gardens of Pamplemousses*) in 1849. The new Director showed activity and devotion and succeeded in completely restoring the Gardens. For fifteen years he collected locally and imported from abroad numerous species including the " Cayenne palm " or " Royal palm " of the Antilles — Oreodoxa regia ".

3 — Records of bud rot on the royal palm.

The first reference to the existence of a bud rot on the royal palm which has come to the notice of the writer is the mention by W.T. Horne of the disease in Cuba in 1908 (13). The following is quoted from that author :

" Some of the best authorities have been inclined to think that the royal palm was sometimes attacked. In the neighbourhood of Naguaraje in a badly affected coconut grove there were several fine specimens of the royal palm which might have died of this trouble but the tops were already fallen.....

The royal palms on the high limestone ridge back of Baracoa were in bad condition and some of them were dying .....This condition seemed attributable to excessive drouth.....".

J. R. Johnston in 1912 (17), after quoting Horne, also referred to the existence of bud rot on the royal palm in Cuba. He says :

" The writer has noted dead and dying royal palms near Baracoa during the past three years. There were not, however more than 15 or 20, nor did the diseased trees have just the appearance of coconut trees affected with the bud rot. In the royal palm the central leaves remained healthy longest, while the surrounding leaves gradually turned brown and fell off. "

Johnston adds that in 1940 he made attempts to isolate *Bacillus coli* from the diseased royal palms, but that the small quantity of these germs found present in the well-rotted tissues was no proof as to this royal palm trouble being bud rot as he had described on the coconut.

G. H. Martin in 1924 (20) speaking of the royal palm in Florida, stated that :

" Curly leaf, of unknown origin, produced a serious disease of the same palm, which eventually killed the plants attacked. "

C. Heusser in 1928 (12) described a crown disease of the oil palm in Sumatra, characterized by rotting of the spindle followed by recovery. It is stated that similar symptoms have been observed on the royal palm.

R. Leach in 1946 (18), speaking of an unknown disease of the coconut palm in Jamaica says :

" Associated with the outbreak of the disease on coconuts at Gonaives, there has been an equally sudden and serious mortality of date palms (*Phœnix dactylifera*) and even a few royal palms... have been killed in the same area..... "

The above are the references which the writer has found about the existence of diseases ending in a bud rot on the royal palm in foreign countries. They have been quoted here without any implication that they are or that they might be of the same nature as the disease in Mauritius.

As regards the occurrence of the disease in the island, the earliest record is apparently that by Henri Robert, Statistician of the Mauritius Chamber of Agriculture who, writing in 1913 (34) stated in connection with an outbreak of coconut bud rot in the island that the presence of the disease has been supected :

" sur le palmier de Cayenne (Oreodoxa regia) qui, très sensible à cette maladie disparaît rapidement du pays. "

Thus the royal palm introduced in Mauritius roughly between 1850 and 1860 was, by the year 1913, owing to a rot disease of the bud, " rapidly disappearing from the island ". The disease, always spectacular on such a stately tree as the royal palm, must have been at that time, of sufficiently common and widespread occurrence here, to have warranted such a fear.

In perusing the Annual Reports of our Department of Agriculture, the repeated mention of a bud rot of the royal palm in the island strikes one as contrasting strangely with the paucity of references to the disease elsewhere. These references run thus :

In 1916 (1) : " Bud rot disease attacked most of the Cayenne palms Oreodoxa regia " in the Royal Botanical Gardens of Pamplemousses. " Young plants appear to suffer less. "

In 1924 (36) : " Palm trees (*Oreodoxa regia*) at Pamplemousses were affected with a bud rot apparently of bacterial origin. "

In 1927 (10) " Research work was performed on the diseases which affect the coconut tree and palm trees specially the royal palm *Oreodoxa regia.* "

In 1928 (37) : " Royal palm (Roystonea regia). A rather severe outbreak of a bud rot was observed in the vicinity of Grand River North West. The symptoms of the disease suggested the direct attack of a parasite on the " heart " of the trees... "

In 1931 (38) : " Royal palm (Roystonea regia) — Bud rot — Cause undetermined ".

In 1944 (42) : " Heart rot of the royal palm *Roystonea regia*, apparently of bacterial origin. This disease is under investigation by the Assistant Plant Pathologist. "

In 1945 (30) : " The researches started in 1944 on the bud rot of the Royal palm *Roystonea regia* O. F. Cook were concluded this year by the identification of its causative organism as *Bacterium vasculorum* (Cobb) Gr. Smith. *Xanthomonas vasculorum* (Dowson). A preliminary note on the subject was published in " La Revue Agricole de l'Ile Maurice, Vol. 24, No. 2 ".

In an unpublished note dated 22.7.27, Tempany, then Director of the Department of Agriculture, stated :

" the matter is worth careful investigation as it is possible that we may be in presence of something not previously described, being given the generalized character and frequent occurrence of the disease here. "

Dr. Tempany was right : We were in presence of something not previously described.

We must note from the above quoted extracts that the disease on the royal palm has been of nearly continued occurrence in Mauritius since 1913. Henri Robert's fear that the plant might be " rapidly disappearing from the island " has not materialized, but there is no doubt that the disease has discouraged the planting of that stately member of the palm family, the " mountain glory " of the Western Tropics. There has happily been for some time past, a tendency to renew the cultivation of the plant, and through the resistance to gumming disease of our present sugar cane varieties, perhaps shall we see and hear much less of the disease on the royal palm than in the days of Henri Robert and of d'Emmerez de Charmoy (see next).

4 — Early Studies of the disease in Mauritius.

a — *Researches by D. d'Emmerez de Charmoy.*

Bud rot of the royal palm was first studied in 1913 by D. d'Emmerez de Charmoy, Entomologist of the Department of Agriculture (9), who, following Johnston's views which had been made known but the preceeding year, attributed it to a bacterium which he had isolated from the diseased palms and which, studied at the Bacteriological Laboratory of the Medical and Health Department at Réduit, had been found to belong to the *Bacillus coli* group. The following extracts are given from the unpublished report which d'Emmerez wrote on the subject :

" To the Director of Forests and Gardens,

Sir,

Agreeably to the wish expressed by you that I should try to elucidate the cause of the disease now prevailing on the Cayenne Palms in the colony and more specially in the Royal Botanical Gardens of Pamplemousses where a great number of trees have already been destroyed, I have the honour to submit the result of the observations which I have made and which would tend to prove that this disease is undoubtedly the coconut budrot which a few years ago attracted the attention of the mycologists of the West Indies and is still causing the greatest anxiety...

It is but very recently that the real cause of the disease seems to have been found out by Mr. Johnston of the U.S.A. Department of Agriculture who succeeded in isolating a bacillus so like the common B. coli that it is impossible to distinguish them....."

Cultures were made of material from diseased trees, from which d'Emmerez isolated two species of bacteria ; he continues thus :

" I am much indebted to Mr. R. David for having carried out with the assent of the Medical Officer in charge of the Bacteriological Laboratory, the following biochemical reactions and for having afforded me every assistance he could when dealing with the microbiological part of this question....."

Mr. R. David who carried out the tests was to become later Dr. R. David. Whilst a student under Dr. Lafont at the Bacteriological Laboratory, Réduit, he had discovered in 1909 the existence of a protozoan flagellate in the latex of the milkweed *Euphorbia hirta* L. (*E. pilulifera* L.) and Dr. Lafont in his honour named the new flagellate *Leptomonas davidi*. We may remark here that it was not previously known that, like animals, plants suffer from protozoal diseases, and David's discovery opened a new line in the protozoological science and aroused intense interest amongst medical and veterinary workers engaged in the study of diseases caused by flagellates.

D'Emmerez in his report gives the biochemical reactions studied by David and concludes thus :

" Bacillus No. 1 belongs to the B. coli group. So its presence in the diseased Cayenne Palms coupled with the external and internal signs above mentioned leads one to the conclusion that this disease is similar to the cocoanut bud rot ".

We must note that d'Emmerez who speaks of the " internal signs " of the disease makes no mention of production of gum ooze by his diseased plants, which symptom is characteristic of the disease studied by the writer. We have therefore to conclude that either the disease referred to by d'Emmerez is not the one which is discussed in the present paper, or that the gum ooze escaped his attention, which the writer is inclined to believe to have been the case.

b — *Researches by W. H. Edwards.*

In 1927, a new outbreak of bud rot of the royal palm occurred in the island and in a letter dated 26th. May, 1927, S.F. Ashby, Mycologist of the Imperial Bureau of Mycology at Kew, replying to a query from Dr. H. A. Tempany for information on the subject, stated :

" I can find no record of a definite bud rot of the royal palm ".

He mentioned Johnston's observations already referred to on dying royal palms in Cuba, adding that the symptoms described by that author :

" are suggestive of wilt disease connected with root failure. "

Meanwhile, W. H. Edwards, then Acting Botanist and Mycologist of the Department of Agriculture, who had been studying the disease, had come to the conclusion :

" 1 — That this virulent disease has no connection with root failure as observed in Cuba by Johnston on *Roystonea regia*.

" 2 — That the disease which prevails here can be classed on the pathological symptoms as a " bud rot ".

" 3 — That there are good reasons to believe that the causative organism is a bacteria which invades from the exterior the inner tissues of the cabbage by the base of the younger leaves and ultimately gains access to the bud which becomes destroyed ".

The above is an extract from a letter dated 30th September, 1927, from Tempany to the Director of the Imperial Bureau of Mycology. Mention was made in that letter that the bacteria are found present :

" in the ooze which exudates from the severed vascular bundles close to the bud of the tree. "

A royal palm cabbage in the early stages of the disease and preserved in formol was forwarded to the Imperial Bureau of Mycology, and S. F. Ashby, writing in January 1928, said that the cabbage had been received in good condition and reported as follows :

" The young tissues above the growing point had undergone a soft rot, the adjacent leaf sheaths were corroded and softened in patches and showed a number of small isolated sunken spots ; the actual growing point and the leaf primordia immediately investing it were, however, free from rot. The affected tissues, including the small spots, showed bacteria present in abundance but no trace of a *Phytophthora* has been detected nor any indications of any other fungus. The condition

of the cabbage was such that the growing point must soon have become infected and destroyed. The specimen had been cut off about 8 inches above the growing point so that the longer upper portion of the column of over-lapping leaf sheaths has not been available for examination. It is possible that spots caused by *Phytophthora* penetrating a succession of the sheaths may have been present higher up in the column and initiated infection (probably by means of zoospores) of the tissues near the growing point and that such lesions were entered by soft-rotting bacteria which greatly extended the rot in such tender tissues and obliterated all trace of the primary agent. This is the more probable if there were no indications that the tree was diseased in any other part and appeared to be in a normal state of health....."

Ashby then stressed the view that the evidence presented by Johnston of a specific bacterial bud rot disease due to *B. coli* or related bacteria was not considered satisfying by a number of mycologists, whereas *P. palmivora* Butl. (*P. faberi.* Maubl.) had been generally accepted as capable of producing bud rot of palms, and concluded :

" In cases where the palms appear to be quite healthy and the first signs of disease are restricted to the youngest visible leaves, the evidence available indicates that some other parasitic agent should be looked for before bacteria, which are always present (especially those related to *B. coli*) receive consideration as the probable primary cause of the shoot-rot or bud-rot ".

E. F. S. Shepherd, the Botanist and Mycologist of the Department, had then returned from absence on leave and Edwards was no longer connected with his Division. Referring to Ashby's letter, Shepherd wrote (unpublished) :

" I shall endeavour to isolate the Phytophthora which he believes responsible for the trouble from *freshly* diseased palm cabbages as soon as any are available ".

Edwards was right however, and our royal palm bud rot is primarily caused by a bacterium, as will be shown lower down.

It is very unfortunate that the whole " crown-shaft " of the diseased plant was not forwarded to Kew. in spite of the difficulties which the transport of such a bulky material would have entailed. Ashby would then have witnessed by himself the complete absence of Phytophthora lesions on the outer sheaths and would have been compelled to rule out infection from that source. The presence of bacteria only, primarily located in the vascular bundles even in otherwise apparently healthy parts of tissues, coupled with the fact that his attention had been drawn to an oozing of gum from the severed bundles of the stem, would have inevitably revealed to him that he was in Tempany's words, " in presence of something not previously described ". That failure, together with the Phytophthora-mindedness of the time, delayed the recognition of the existence of a specific bacterial bud rot of palms for many years then to come.

4 — Outbreak of the disease at Rose-Hill in 1944.

In December 1944, an outbreak of bud rot occurred on tall royal

PLATE V

Phot. 1 — Bud rot on royal palms in an avenue in Malartic Street in Rose-Hill.

The photograph shows the condition of the trees in January 1946. The bottom part of the stem of two of the plants cut for examination on 5.12.44 can be seen in the picture. The avenue curves to the left in the background, where the denuded stems of 3 Roystonea plants detach themselves from a group of 5 trees. The row is thence continued by areca nut palms, the stems of two of which can be made out close together.

Phot. 2 — Longitudinal half of two diseased palm cabbages cut on 5.12.44. Outer sheaths removed.

The cabbage on the left came from a plant with wilting outer leaves, but with the heart leaf pushing out just starting to dry out at the tip. Somewhat lower down inside the spindle, the leaflets were still unaffected, but near the base, the central core of young leaves and the tissues of the growing point had completely rotted. The folds on the young sheath probably result from compression by the overlapping sheaths of those young leaves which, according to Edwards (p. 231), remain stunted in development; they indicate some long standing by the disease. The external wilting of the leaves of the central spindle, occurring at a time when the tissues inside are in such an advanced stage of decomposition, points however to a very rapid collapse of the tender tissues above the growing point, once the infection has reached the base of the central core of young leaves. The rapid collapse in this region may possibly be the direct work of putrefactive bacteria.

The cabbage on the right was from a tree with the heart leaf completely dried out Note the extreme collapse of the central tissues and young region, the gum pockets in the stem, and the infected vascular bundles on the cut surfaces of the leaf sheaths. The small black patches on these surfaces indicate the location of the " softened patches " and " isolated sunken spots " (cf. Ashby's description, p. 229) which are seen on the internal surface of the young leaf sheaths of diseased plants.

Phot. 3 — White palm plant in foreground, inoculated with the royal palm isolate (e_8), on 26.3.46 ; photographed January 1946.

Phot. 4 — Royal palm plants inoculated into the stem and the crown shaft with e_8 culture on 26.3.45. Photographed February 1946.

The heart leaves had collapsed a few months after the inoculations, but the outer leaves remained healthy and were broken off by a cyclone which occurred on 31.1.46.

PLATE V

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palms in the entrance to a private residence in Malartic Street at Rose-Hill. When the occurrence of the disease was made known to the writer, the affected trees were unfortunately in a late stage of the disease, and five trees were seen dying, with many of the leaves of the crown fully dried out. It was hoped that it would be possible to study the early stages of the disease and its development on other trees in the avenue which might contract the disease later. Up to the time of writing, eleven trees on the whole have died in that avenue, but the cumulated effects of repeated cyclones defeated our hopes. In January, February and April of 1945, the island experienced three cyclones, the centre of the first of which actually passed over the island and that of the second almost touching it. *Roystonea regia* is a palm whose leaves are easily broken during cyclones and in consequence, these palms over the whole of the island suffered immense damage. The six other trees which died later never recovered their crowns, and as no new case of the disease has been observed since, save one tall tree which died in July 1946 at the Royal Botanical Gardens, our present study is to some extent incomplete in so far as lacking personal observations on the early stages of the disease.

5 — Symptoms of the disease.

The description of the symptoms given below is based on the observations made on the few trees examined at Rose-Hill in December 1944, when three palms were cut down for the purpose. It was during that examination that production of gum ooze was observed, and that symptom, in the light of the writer's previous experience with the disease of the Dictyosperma palm (25, 26, 28), directed the trend of his researches.

On the Dictyosperma palm, a definite blight of the leaflets can be observed on the leaves of the crown before the affected plants have reached the bud rot stage ; but it is difficult to make critical examination of the leaves of tall palms from the ground below, and it is possible that the six royal palm plants which succumbed later at Rose-Hill may have been showing some early leaf symptoms on the crown in December 1944. Nothing conspicuous however was observed from below and the gross picture which struck the writer was more that of a wilt in which the leaves turn brown and dry out, rather than of a blight as on the white palm.

We said that we were not in a position to give a personal description of the early stages of the disease, but we have, fortunately, Ashby s observations (loc. cit) on the condition of the inner tissues of the royal palm cabbage sent to him.

In Tempany's above-mentioned letter, the plant from which the cabbage had been removed was stated to have been :

" Showing typical lesions observed at the earlier stages of the disease, i.e., when the leave are still green though the younger ones are somewhat stunted and stand erect ".

On those trees we studied, the outer leaves of the crown were dead or drying out when seen, and the middle leaves and whorl of young ones were beginning to fail but were still on the whole green when the youngest leaf opening from the central spindle started to wither from the tip backwards. Some trees showed the whole of their crown nearly completely dried out at that time.

When the heart leaf shows the drying at its tip, on cutting open the cabbage, the bottom portion of the core of young leaves inside and the growing point of the stem are all observed to have become involved in a vile, stinking, soft rot, while higher up inside the shaft, the young leaflets of the spindle leaves are still white and apparently unaffected. Photograph 2 of Plate V shows the collapse of the internal tissues at that stage. Numerous small cavities containing dirty-white gum may be present, in the tender tissues of the stem, where also the vascular bundles are observed to have turned yellow to brown in colour.

The youngest sheaths inside the shaft are sometimes thrown into folds and are rotten at the edges, and the sheath enclosing the rotting cylinder may show its internal surface as if it had been charred. Towards the base of the young sheaths, the infected vascular bundles can be traced by transparence from the internal surface as long, yellowish-brown lines, often with sunken patches of varying sizes along their course. Gum exudes from such patches and apparently brings about by direct contact the rotting of the enclosed younger leaves. (See Explanation phot. 2, Pl. V).

The cut vascular bundles of the diseased plants slowly ooze drops of yellow gum (Pl. VI, phot. 5), the exudation being produced by fewer and fewer vessels, the further down the stem the section is examined. On a tree in which the crown leaves had just completely dried out, the ooze was observed from a few vessels amidst perfectly sound ground tissue as low down as some twenty feet from the rotting cabbage, whilst sections nearer the top were oozing gum in greater abundance. Even taking into account the fact that the tender tissues of the top are much more susceptible to rapid invasion than older tissues, the whole internal picture suggests that the disease in the stem travels downwards from the top, not upwards from the roots. With time, evidently, these latter are also invaded by the bacteria, as was shown by the examination of roots of young plants artificially inoculated into the stem with the organism (Pl. VIII, phot. 19).

As the rotting of the tender tissues of the stem progresses, the plant becomes more and more top-heavy, until the crown-shaft with what may remain of its dried out leaves finally slips down one day, leaving a bare, chimney-like, columnar stem, to stand for several years before being ultimately rotted down to the ground (Pl. V, phot. 1). In table I are brief notes, taken on three different dates, referring to the condition of the trees shown in the photograph.

TABLE I

Date	Order of the tree in photograph 1, from the extreme right.								
	First	Second	Third	Fourth	Fifth and Sixth	A batch of five	Twelfth	Thirteenth	Fourteenth
December 1944 ...	Healthy	Healthy	Healthy	Healthy	Diseased. Cut down for examination	Healthy	Dying	Healthy	Healthy
January 1946 ... (*photograph taken*)	Bare stem left	Dying	Healthy	Bare stem left		Healthy	Bare stem left	Bare stem left	Bare stem left
September 1947 ...	Stem rotted to half its height	Stem rotted to one-fourth of its height	Apparently healthy	Rotted half its height		Healthy	Levelled to the ground	Rotted half its height	Rotted half its height

7 — The investigations for the pathogen.

Before describing the researches which we effected, we have to mention that when we started our investigations, we were not aware of Edwards' findings about the production of gum by the diseased plants; we had likewise no knowledge of the opinion Edwards had reached about the nature of the disease. The work effected in our search for the pathogen of the bud rot of royal palms in the island is discussed hereafter under the following headings :

a — Preliminary work with the natural gum ooze,
b — The isolation of the pathogen.

a — *Preliminary work with the natural gum ooze.*

1 — *Examination of the gum and of the gum-containing tissues :* On 5.12.44, after the material selected at Rose-Hill for study had reached the laboratory, smears were made of a suspension in sterile water of the aseptically removed ooze, and stained with Carbol Fuchsin. Microscopical examination revealed that the gum was full of small, rod-shaped bacteria. Sections made from the diseased tissues showed that the gum is located within the xylem vessels of the bundles (Pl. VIII, phots. 15 to 18). In sections of young tissues, the walls of the bundles are often seen to have broken down and the bacteria to have invaded the surrounding parenchyma tissue, resulting in the formation of gum "pockets".

2 — *The slide test* : Rather thin longitudinal sections of stem tissues comprising yellowish-brown vascular bundles were cut and examined in a drop of water under the low power of the microscope. The bacterial gum was observed to ooze from the bundles through absorption of water in the manner characteristic of *Xanthomonas vasculorum* (Cobb) Dowson and already described by the writer elsewhere (26). Even to the naked eye, or under a hand lens, the ooze is observable as a pronounced milkiness about the ends of the bundles, when the slide is examined against a dark background. This test has regularly been used throughout the course of the present work to give a rough indication of the presence or absence of the pathogen in the bundles of the tissues examined, prior to more critical study. Portions of leaf stripe tissue afford the best material for the test.

3 — *Inoculations with the gum from Rose-Hill and from R.B.G. material* : On 5.12.44, the aseptically-removed gum was made into a thick suspension with sterile water and used to inoculate three sugar cane leaves of the variety M. 117/35. The inoculations were effected at three different levels of each leaf, using North's technique for blade inoculation (21). This consists in placing drops of suspension on a healthy green sugar cane leaf and making numerous light pricks through with a

PLATE VI

Phot. 5 — Portion of the stem of one of the diseased royal palm plants cut on 5.12.44. Section at about 1 foot below the insertion of the lowermost sheath.

The tender parts of the stem split into pieces when the stem hit the ground on the tree being cut. The crown of the plant had completely dried out, but the crown shaft was still attached to the stem. The cut portion of stem had been kept overnight in a moist atmosphere before the photograph was taken.

Phot. 6 — The royal palm pathogen, culture e_8, showing the single polar flagellum. Stained by Gray's method. x 900.
Ilford Special Rapid Panchromatic Plate. Wratten No. 58 (green) filter. Phot. 27.3.45.

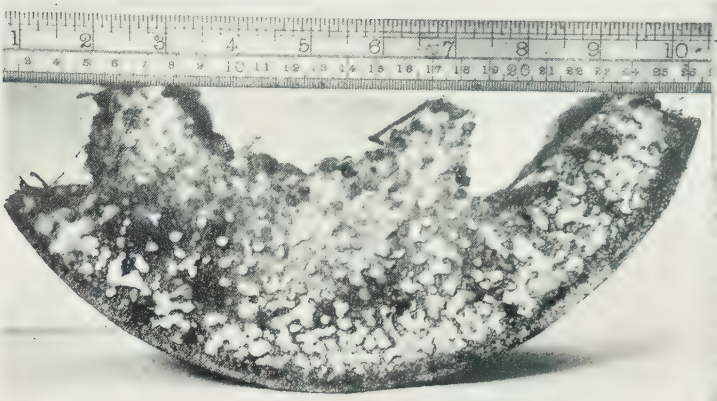
Phot. 7 — Leaf stripes following spindle inoculation of the broom bamboo, *Thysanolæna maxima*. Phot. 23.3.45 by transmitted light on Ilf. Rapid Process Panchromatic plate. Wratten No. 25 (red) filter.

The two leaves on the left inoc. with the royal palm culture e_8, and the leaf on the right with the gumming disease pathogen from the sugar cane, on 5.3.45.

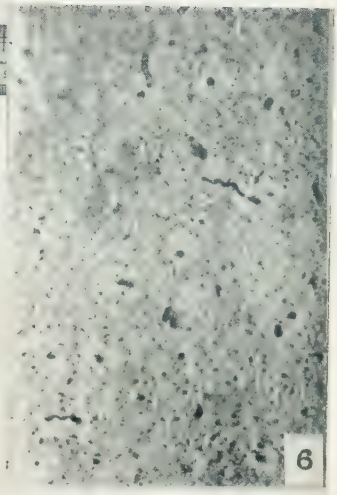
Phot. 8 — Leaf stripes following blade inoculation on sugar cane, variety 55P. Inoc. 20.2.45. Phot. 6.3.45, by Tr. light on Ilf. Rap. Proc. plate. Wratten No. 25 (red) filter.

Control pricks opposite the inoculated areas ; the latter marked by a black circle.

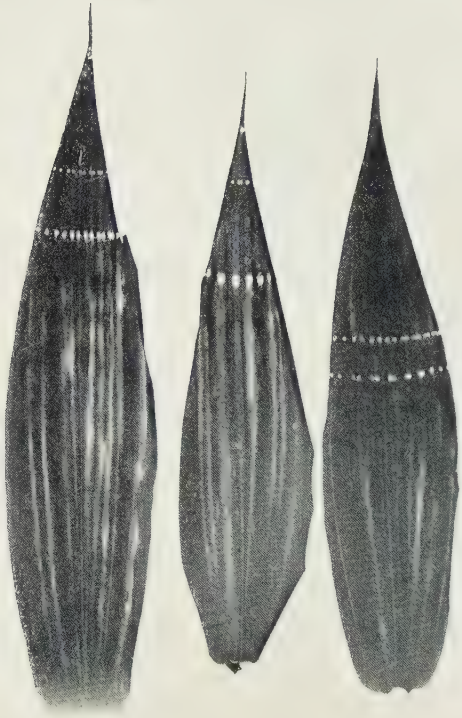
PLATE VI



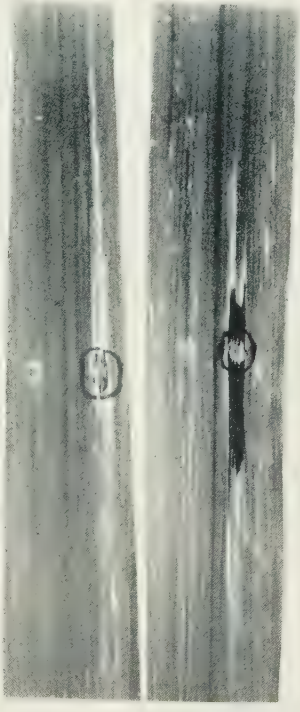
5



6



7



8

lorum grows easily on the medium, but the growth of our first cultures was so poor and erratic that it perplexed us and we had nearly been led to believe that the causative agent was not *X. vasculorum*, when our preliminary inoculations already described convinced us that such was not the case. A few of these first cultures had, however, yielded a yellow growth which we considered to be the right organism, and subsequent cultures resulted in as easy an obtention of growth as is commonly the case with *X. vasculorum* on the medium. The difficulties experienced may have been caused by some unnoticed technical error during the preparation of the particular batch of medium in the laboratory. The uncertainty we were in at that time, or the uncertainty we had been in for a time, explains the large number of inoculations made with the cultures which we isolated, as will be seen lower down.

For the work contemplated, the internal tissues of the bole portion of the stem of one of the palms examined at Rose-Hill, that is, taken from the central part of the stem at a height of about 3 feet from the ground, and comprising vascular bundles oozing the pure yellow gum, were used. Portions from the samples were cut of convenient size for plunging into 500 c.c. beakers containing 90% alcohol ; after immersion for about 2 minutes, they were withdrawn with tongs, allowed rapidly to drain and flamed. They were then placed on a flamed Technolite slab in the culture room and small portions were cut off with a sterile knife and placed on the slab under a flamed bell jar. From the material prepared, the following cultures were made :

a — *Tissue cultures.* Small bits of tissue from freshly-cut surfaces were directly transferred to agar slants.

b — *Gum cultures.* After about half-an-hour under the bell jar, the gum ooze from the bundles was removed with a sterile platinum loop and streaked along the surface of agar slants.

c — *Dilution cultures.* These were made from suspensions in sterile water of the gum removed as under (b).

d — *Streak cultures.* For these, thin portions of tissue with yellow bundles were removed and their ends cut square with sterile scissors and at right angles to the direction of the bundles. The pieces were wetted with sterile water to promote exudation and streaked lightly and rapidly along the solidified surface of the medium poured in Petri dishes. Such cultures, generally from the leaf stripe tissue of the inoculated plants, result easily in the production of isolated colonies along the streaks, provided the disinfection has been good. The stem cultures were not very successful.

Cultures as above described were made on December 5th., 8th., and 18th., 1944. As already said, the number of successful cultures was low

in the first series; but on the whole the "dilution cultures" then made gave better results and colonies were fished from them and alphabetically labelled. Numbers were affixed to the different letters to indicate the page of the laboratory book dealing with the research, where the particular notes about the cultures were entered.

Of the cultures so obtained, which were all characteristic of *X. vasculorum*, those labelled e_8, f_8, and t_{11}, together with one bearing the laboratory number a_3, a direct gum culture obtained on 16.12.44, and the already mentioned a_{12} culture (p. 235), were selected for inoculation work. Cultures e_8 and f_8 were isolated on 18.12.44 and cultures q_{11} and t_{11} on 23.12.44 and 30.12.44 respectively.

On 13.8.46, "tissue", "gum" and "streak" cultures were made from material brought from Pamplemousses. On 16.8.46, yellow bacterial growth had started in the cultures and colonies were fished out under the lens on 20.8.46. Of these, three, labelled R.B.G. 1, R.B.G. 4 and R.B.G. 7 were used in the inoculation work.

8 — Variation of the organism in culture.

During the course of our study, it was often noticed that our cultures, originally fished from single individual colonies of quite uniform structure as observed under the lens of the dissecting microscope, showed certain changes in their appearance later, and the production of variants was in consequence suspected.

Dilution plates were made from suspensions of e_8 cultures, originally finely granular, and the following colonies were for example obtained: e_{8a}, finely granular; e_{8g}, coarse granular or grumose; e_{8d}, reticulate; e_{8f}, resinous-like and deeper yellow in colour. The finely granular type of colony or of growth in tubes is apparently the one chiefly obtained from cultures of direct material from newly affected tissues and is the one most frequently encountered in the plates made from previously obtained growths; it is thus apparently the standard type for the organism. Dilution cultures were not made of ooze from parts in an advanced stage of disease, where such types may perhaps also be encountered.

North (21) states that *X. vasculorum* produces stable variants in culture, but those obtained by the writer were unstable in character. Thus dilution cultures of the above-mentioned seemingly pure sub-cultures after standing for some time showed in their turn indications of variation. From the growth from a coarse-granular type, both finely and coarse-granular colonies were observed in dilution plates made; resinous-like colonies were very few in number. Similarly, from plates of freshly-obtained growths from "tissue cultures" of R.B.G. material, the following types were obtained: finely punctate, R.B.G. 1; grumose or coarse granular, R.B.G. 4; and a somewhat stellate-shaped colony, R.B.G. 7.

The reactions of the various cultures on milk and on starch and nitrate media were examined, without differences being observed towards

the e_8 and G cultures (see below) as standards. Some of the variants liquefied gelatine (in Peptone-Saccharose medium) much more slowly than the other cultures.

The following table gives the results of the inoculations with the variants tested, a + sign meaning that gumming stripes were observed.

TABLE II

Inoculations			Cane variety	Culture	Date of observation	Result
Date	Type	Number				
30.5.45	Blade	6	55P	e_{8a}	25.6.45	+
	,,	6	,,	$e_{8\,3}$	15.6.45	+
	,,	6	,,	e_{8d}	,,	+
	,,	6	,,	e_{8f}	,,	+
5.12.45	Blade	24	M55/1182	Four subcultures corresponding apparently to the above.	3.1.46	+
	Spindle	4	,,		,,	+
14.8.46	Blade	6	,,	e_{8a} Repeat test	14.9.46	+
	,,	6	,,	$e_{8\,3}$,,	,,	+
	,,	6	,,	e_{8d} ,,	2.9.46	+
	,,	6	,,	e_{8f} ,,	14.9.46	+
29.8.46	Spindle	2	,,	R.B.G. 1	,,	+
	,,	2	,,	R.B.G. 4	,,	+
	,,	2	,,	R.B.G. 7	,,	+

9 — Proof of pathogenicity.

The pathogenicity of the cultures selected was first tested towards (a) the sugar cane, (b) maize ; and when proof beyond doubt had been obtained that they were *X. vasculorum*, one of them only, the e_8 culture, was tested further towards (c) the royal palm, (d) the coconut palm, (e) the " white " or " princess " palm, and (f) the Indian " tiger grass " *Thysanolaena maxima* (Roxb.) O. Kuntze.

The first inoculations on sugar cane were checked against *X. vasculorum* by parallel inoculations with a culture labelled R. V. of freshly-removed aseptic ooze from a gumming-diseased M. 55/1182 sugar cane stem. The later inoculations on all the plants mentioned, were checked against a pure culture of *X. vasculorum* isolated from sugar cane leaf stripe and labelled G. The check inoculations with the G. culture on the royal palm, constituted the necessary cross-inoculation work with the sugar cane pathogen on the plant. The cultures used for the various inoculations were always young, about 24-hour-old cultures.

(a) — *Inoculations on sugar cane.*

The inoculations into sugar cane were made by North's techniques for both blade and cutting inoculations (21), the first of which has already been described. The latter consists in inoculating the ends of freshly prepared cuttings with a few drops of suspension, and planting the cuttings. After 4-6 weeks in the soil, they are removed, washed free from adhering soil and the ends are cut back to the white tissue within. The cuttings are then " sweated " under moist bags for half an hour and the cut ends then examined. In case *X. vasculorum* was present in the suspension used, drops of gum are observed oozing from the infected bundles.

Leaf inoculations.

The leaf inoculations were made on blades and spindles of M55/1182 a sugar cane variety very susceptible to the gumming disease. Twelve blade and two spindle inoculations with twelve controls were made on 5.1.45 with each of the cultures a_5, a_{12}, e_8, q_{11} and t_{11}. Twenty-four blade and four spindle inoculations, with twenty-four controls were made at the same time with the B.V. culture.

The large amount of field work entailed by these inoculations was unfortunately ruined by the occurrence of the cyclone of January 14-16, 1945, the centre of which passed right over the island. Some time was necessary for new cane leaves to develop, but another cyclone shortly followed on February 2nd, and delayed the work still more. It was however found possible to inoculate newly opening leaves on February 20, and this time, only the pure cultures e_8, q_{11}, t_{11}, and G were used and only blade inoculations were made. Two cane varieties were employed, M55/1182 and the moderately susceptible 55P sugar cane. The following shows the work effected in this instance :

TABLE III

Variety	Culture	Inoculations	Controls
55 P	e_8	13	13
,,	q_{11}	6	6
,,	t_{11}	8	8
,,	G	10	10
M 55/1182	e_8	12	12
,,	G	12	12

The inoculated areas were distinguished from the controls by Indian ink marks, and after the work was over, we noticed that we had this time encircled the inoculated centres with ink instead of the controls as we were wont to do. On 2.3.45, all the inoculations were noticed to have picked up infection, and on 5.3.45, abundant yellow stripes had been formed by the royal palm isolates on the 55P. variety; the affected tissues having in many cases dried out up to a length of some 1 inch above and below the punctured zone (Pl. VI, phot. 8). With the G culture on the same variety, stripes were then just beginning to form. The stripes had by that time also appeared on the 55/1182 leaves, but they were less advanced in development than on the former variety. The controls remained all healthy, as they invariably did. Apparently the three isolates from the royal palm were more virulent on the 55P. cane leaves than on those of the 55/1182 variety, and their virulence on both varieties was greater than that of the isolate from sugar cane.

Inoculations were also made with R.B.G. material as follows: On 14.8.46, a suspension of the direct ooze was inoculated into 2 spindles and 6 blades of 55/1182 and on 2.9.46, gumming stripes had developed from the punctures. The pure cultures R.B.G. 1,4, and 7, were also inoculated into 2 spindles each of the same variety on 29.8.46 and when examined on 14.9.46 the punctures had all developed the characteristic stripes.

Inoculation of cuttings. For the preparation of the cuttings, shoots of the variety M 134/32 were used, in spite of the fact of the variety being highly resistant to gumming disease. The experiment was begun on 5.1.45 and as the harvest season was then over, no other variety was available to the writer of sufficient size of shoots for the purpose. The shoots which were cut were lettered differently and the cuttings from each were numbered in succession. The even-numbered cuttings were kept as controls and the odd-numbered ones were inoculated.

Considering that the variety used was a resistant one, precautions were taken for a massive infection of the cuttings; so a small hole with a flamed cork borer was made towards the middle of each cutting after disinfection of the rind with alcohol and flaming in the region where the hole was to be made. A few drops of suspension were poured into the hole which was then plugged with melted paraffin wax.

The cuttings were planted in a furrow and their individual location noted. A first batch containing at least one cutting inoculated with each culture was uprooted on 1.2.45, i.e. 4 weeks after planting, and sweated. The remainder was uprooted on 19.2.45, or after about 6½ weeks in the soil; but they had become too badly affected with the pineapple disease caused by the fungus *Ceratostomella paradoxa* (de Seynes) Dade, and produced no ooze.

In the fear that negative results might be obtained from the experiment described, considering the resistant nature of the variety used, another experiment was run, using cane shoots of the DK/74 variety, one

PLATE VII

Phots. 9 & 10 — Portions of leaves from maize plant inoculated into spindle on 27.11.37 with the gumming disease pathogen isolated from sugar cane. Phot. 13.12.37. Ilf. Rap. Proc. Pan. plate ; Ilf. Gamma filter. Transmitted light.

Note that the affected veins sometimes show small beads or short interrupted white lengths along their course, and that they may start some distance from the puncture. Note also the broad white stripe formed ; numerous small necrotic centres may develop in such stripes.

Phot. 11 — Three maize leaves from plants inoculated into spindle on 20.2.45 with culture e_8 from the royal palm. Phot. 9.3.45. Ilf. Rap. Proc. Pan. plate ; Wratten 25 (red) filter. Tr. light.

Phot. 12 — Half of blade of white palm leaflet, from naturally infected plant. Leaflet just opening into the air. Ilf. Sp. Rap. Pan. plate. Phot. Tr. light, 1937.

Plant in last stages of the disease. Infection (primary) passing upwards from the stem into the leaves. Note the infected discoloured veins.

Phot. 13 — White palm leaflet just opening into the air, from a plant inoculated into the spindle with the royal palm pathogen. Inoc. 20.3.45 ; Phot. 18.6.45. Ilf. Rap. Proc. plate. Wratten No. 25 filter (red). Transmitted light.

Phot. 14 — Coconut leaflets from spindle-inoculated plants.
The 2 leaflets on the left showing infection from the pathogen isolated from sugar cane ; the two on the right, from the royal palm organism. Plants, inoc. 26.3.45. Phot. 2.5.45. Rapid Proc. Pan. plate. Wratten No. 25 filter. Transmitted light.

Note the discoloured vascular bundles present in the yellow tissues of the blade. The necrosis sometimes observed occurs inside the spindle ; if the leaflets open out without having rotted, they simply wilt and dry out.

PLATE VII

moderately susceptible to the disease. The shoots were of small size, and they were pulled off from the stools and not cut off, in order to take advantage of the more mature part of the rhizome. Such cuttings were formerly sometimes used for recruiting in the fields when cuttings were scarce ; they are locally known as "drageons", a name meaning suckers. They were inoculated on 12.1.45 and uprooted on 20.2.45, i.e. after 5 weeks in the soil. The results of both experiments are tabulated below, a + sign indicating that gum ooze was observed. The controls were all healthy.

TABLE IV

Culture	Cuttings	
	M. 134/32	DK/74
a_5	—	+
a_{12}	+	—
e_8	+	+
f_8	—	+
q_{11}	+	+
t_{11}	+	+
B. V.	+	+

Thus as a result of both the leaf and the cutting inoculations, the royal palm isolates had been proved to be *Xanthomonas vasculorum* (Cobb) Dowson.

(b) — *Inoculations on maize.*

In his previous studies on the hosts of *X. vasculorum*, the writer found that maize was susceptible to the organism, the chief symptoms produced being white veins and white stripes on the leaves, provided young maize plants are inoculated into the spindle before the internodes have elongated (PL. VII, phots. 9 & 10). S. S. Ivanoff in America in 1935 (16) and C. G. Hughes in Queensland in 1938 and 1939 (14), also obtained similar symptoms. In his experiments, the writer used the maize plant as a convenient test plant, both on account of the ease and of the rapidity with which the characteristic symptoms are produced. Thus the first

symptoms develop in from only 3-5 days on the inoculated plants, whereas sugar cane blades require usually three to four times longer.

The inoculations were effected on 20.2.45, by placing a drop of suspension towards the base of the outer sheaths of the spindle, stabbing with a sterile needle through the drop to pierce the spindle right through, and working the needle piston-like three or four times to get the drop well into the hole. The cultures used were e_8, q_{11}, t_{11}, and G, and the number of plants inoculated were respectively, 12, 6, 6 and 12 ; 10 plants similarly stabbed through drops of sterile water served as controls.

Symptoms began to develop on 28.2.45, when a few white major veins were observed on some of the leaves opening out. By 2.3.45, the number of plants which had shown the long white veins and the large, white, sometimes pallid-green stripes on the leaves were respectively 11,6,6, and 9.

The slide test with the stripe tissue showed the presence of the bacterial gum within the bundles. From cultures made of such tissues, two colonies were fished and identified by inoculation into cane. Six blade inoculations into 66 P sugar cane leaves were made with suspensions of each culture on 24.3.45. The inoculated plants were badly damaged by the cyclone of April 6, but it was, however, possible to trace them, and, gumming stripes developed from the inoculated areas on the leaf shreds left.

As for the R.B.G. material, the direct gum ooze and the pure cultures obtained were inoculated into maize in August 1946 and also produced stripes on the leaves. The stems of the dying plants all exuded gum when sectioned.

Thus *X. vasculorum* had been reisolated from the maize plants inoculated with the royal palm pathogen.

(c) — *Inoculations on the royal palm.*

The following experiments were performed on 23.3.45 on young royal palm plants growing in bamboo pots :

1 — 2 plants were pierced into the stem with a dissecting needle and a small quantity of e_8 suspension was injected into the wound by means of a hypodermic syringe. The spindle of the plants was also inoculated by means of the infected needle by puncturing it right through about 2 inches above the growing point.

2 — 2 other plants were treated as above into the stem only.

3 — 2 plants were treated as under (1) above with culture G.

4 — 2 plants were treated as under (2) also with the G culture.

5 — 1 plant was treated as under (1) with a suspension of a *Staphylococcus* culture, and one other with a species of *Xanthomonas* isolated from a leaf blight of the grass *Paspalum dilatatum* Poir.

6 — 1 plant was pierced through both spindle and stem with a sterile needle.

The plants mentioned under 5 and 6 remained healthy and this shows that rotting in palms does not always result from the introduction into the spindle of any organism whatever. The observations made on the other plants were as follows :

On the e_2 plants treated as under (1) above, the heart leaves and those immediately next outside were observed dead on 23.4.45. Upon dissection, the central spindle and growing point were found completely rotted and gum ooze was observed on the cut surfaces of the young sheaths. The tissues around the stem puncture were light brown and many of the fibres in the stem had turned yellow to brown and oozed minute drops of yellow gum.

The plants of the second series showed the heart leaves drying out, one on 29.5.45, and the other on 1.6.45. Symptoms were observed as just described, and besides, the roots also exuded gum when cut ; at least, some did. A section of one such root fixed for three days in Carnoy's fluid and stained by Cottrell-Dormer's method (8) was photographed on 6.6.46. Photograph 18 of Plate VIII shows a portion of the central cylinder of the root, with the bacterial gum occluding one of the large metaxylem vessels.

Cultures were made and one pure re-solate was kept for testing upon sugar cane (see further).

The G-inoculated plants constituted the cross-inoculations necessary in this study. The symptoms produced on these plants tallied with those observed in the case of the e_2-inoculated plants.

Besides young plants, tall about 6 year old plants, were inoculated. In this case, a long needle made of a bicycle spoke strongly fixed to a wooden handle and sterilized by flaming was employed. The needle was driven both through the crown shaft and into the young part of the stem, inoculations being made with e_2 on two plants and with G on one plant. One other plant was punctured with a sterile needle.

The tips of the heart leaves of both the e_2 and G plants were observed to have begun to wither about one month after the inoculations. The progress of the disease was most slow on the outer leaves and a cyclone which occurred on 31.1.46 badly damaged the plants. Photograph 4 of Plate V, which was taken later shows the two e_2 plants with their crown bare of their outer leaves, broken by the cyclone ; the heart leaves had dried out long before.

The plants were completely dead or dying on 4.11.46, save the control plant which up to the time of writing, in September 1947, is perfectly healthy.

The heart, growing point, and young sheaths of the inoculated plants were badly rotted when examined in November 1946, but gum ooze was observable from the still unwithered leaf sheaths. Strangely, however, no trace of gum nor diseased bundles could be seen in the stem tissues. On piercing the stem at the time of inoculation, the needle could not be driven in directly by steady pressure upon the handle, but had to be

rotated somewhat gimlet-like deeper and deeper inside ; it is therefore possible that the bacterial suspension was scraped off from the needle by the outer tissues which did not pick up infection.

This perhaps explains the failure experienced by the writer in his previous researches on the hosts of *X vasculorum* (26), when, among other plants, he inoculated one rather tall royal palm in the young region of the stem below the insertion of the outermost leaf sheath. In the work referred to, he mentioned the royal palm as one of the plants which reacted negatively to his inoculations.

d — *Inoculations on the coconut palm.*

The coconut palm was one of the plants which the writer succeeded in inoculating with the sugar cane gumming disease organism in 1939 (26,28). He therefore performed the following experiments on the plant with the royal palm pathogen, inoculating some 7 year old plants into the spindle only, because their stem portions were still under the ground, and others into both stem and spindle. On 26.3.45, three plants were inoculated with e_8 into the spindle only, two plants in the same way with G, and one plant also with G in both the stem and the spindle. A syringe was used to force the suspensions into the wounds.

Observations on the e_8 *plants* : The punctures on the spindle leaf which had been hit were observed into the air between 20.4.45 and 2.5.45. On the damaged leaflets opening out, long yellowish-white to light-brown veins were observed running up and sometimes also down from the punctures ; certain of the leaflets, rotted nearly right through their whole width about the centre of inoculation, drying out later. The upper part of one heart leaf pushing out wilted and dried out bodily, through the rachis having been punctured and having contracted the disease. The slide test with the discoloured vein tissue was positive, and the organism was recovered from the diseased leaf tissues for inoculation into cane.

On 3.6.46. the plants were observed to be pushing out healthy leaves ; but those punctured showed a " bitten-leaf " appearance through the dried-out portions of the leaflets having fallen off. The infection had not apparently progressed donwards on the leaflets.

At the time of writing, on 8.9. 47, the plants were again inspected and they appeared healthy, the punctured leaves now standing the oldest of the crown. On cutting back the stump-like tip of the rachis of these leaves *just within* the healthy region, one of them exuded a few drops of gum.

The indication given by these inoculations is that the coconut palm appears much more resistant to the organism than either the white palm or the royal palm. This is borne out by the reaction of the coconut palm in nature.

Observations on the G. inoculated palms. The successful inoculations of coconut seedlings has been recorded by the writer elsewhere (26), wherein

it was mentioned that spindle inoculations had resulted in the production of thin, long, yellowish-red bundles in the punctured leaflets, which oozed gum by the slide test, and from which *X. vasculorum* was recovered in culture.

The symptoms observed on the taller plants inoculated in 1945 were similar to those produced by the e_8-inoculated palms. Of the three plants treated in this case, the plant inoculated both into the stem and into the spindle, and one of the two plants inoculated into the spindle only, seem to have completely recovered. The other plant inoculated into the spindle only has continued up to the present to show signs of being diseased, its successive leaves pushing out having all shown a few to many diseased leaflets with discoloured veins, which dried out subsequently. The veins were infected with *X. vasculorum* as shown by the slide test, and the latest young leaf pushing out which has shown signs of rotting towards the middle part of the rachis, has exuded drops of gum on being severed on 8.9.47, in the vicinity of the damaged region. It looks as if that plant will eventually die.

In the infected leaflets of both e_8 and G plants, many of the long, discoloured vascular bundles were seen to have no direct connection with the punctures on the leaflets. They had, however, become infected with the organism, as shown by the slide test ; and it is therefore probable that the infection travels not only longitudinally in the leaflets, but also laterally by way of the cross-connecting veinlets.

Inoculations on the white palm, Dictyosperma album Wendl. & Drude.

During the writer's researches in 1937 (26,28) inoculations of isolates from diseased Dictyosperma plants and the sugar cane had been made into the stem of young white palm seedlings and had resulted about two months later in rotting of the spindle and in death of the plants.

Three 6-7 year old plants of *D. album* each were inoculated with e_8 and G cultures on 26.3.45, by puncturing both the spindle and the young stem and injecting the suspension with a hypodermic syringe.

The e_8 plants — The punctures on the leaflets were out on and after 21.5.45 ; rotting of the tissues was observed about the inoculated areas.

On 28.6.45, one heart leaf was completely dead, and on the two other inoculated plants, the leaflets were showing pronounced brown to black areas of dead tissue, up and down from the punctures. Fine yellow to yellowish-red veins could be seen by transmitted light in the tissues in which chlorophyll had not yet developed (Pl. VII, phot 13).

The pathogen was reisolated from such tissues and proved to be *X. vasculorum* upon inoculation into the sugar cane. Death of the plants occurred later (Pl. V, phot. 3).

G-plants—No major differences were observed between the symptoms produced by the e_8 and the G inoculations.

A photograph of the half of a blade of a white palm leaflet just opening from the spindle of a plant naturally infected with *X. vasculorum* is shown in Plate VII. (phot. 12). The symptoms in this case are primary being produced by the direct passage of the pathogen upwards from the diseased stem into the young leaves of the spindle. The reddened veins indicated by black lines in the photograph should be noted.

f — *Inoculations on the " broom bamboo " grass.*

The tiger grass of India, *Thysanolæna maxima* (Roxb.) O. Kuntze, a member of the Gramineæ growing in dense tall clumps some 8 feet in height, and known locally as " bambou balai " or " bambou fataque " was proved by the writer in 1937 (26,27,28) to constitute one of the natural hosts of *X. vasculorum* in Mauritius. The plant was therefore included amongst those inoculated during the course of the present study, and inoculations with culture G were carried on this time again for comparison with the e_8 cultures.

Blade inoculations were made with e_8 on 12 leaves of *T. maxima* on 5.3.45 and spindle inoculations on 5 shoots of the plant; the latter were effected by puncturing through a drop of suspension placed at two different levels about 1 inch apart at the base of the unopened heart leaf. Similar work was effected with the G culture.

For some unknown reason, the blade inoculations, which had given positive results with *X. vasculorum* in 1937, were this time all negative, but the spindle inoculations were successful. With both e_8 and G, the first punctured leaf, which was seen open on 19.3.45, showed small lengths of white vein, with occasional yellowish-green stripes some $\frac{1}{4}$ inch wide about them. The punctures on these leaves were about one-fourth of the leaf from the base and the stripes ran downwards. On the next younger leaf which always bore the punctures in their upper half, the white veins were long and often quite numerous. They sometimes offered a dotted aspect through the development of small white " beads " with minute reddish-brown centre along their length. Yellowish stripes of irregular width and with diffuse edges developed about the discoloured veins, and the under surface of the affected leaves were of a purplish tinge about the stripes. A photograph of the leaves is shown in Plate VI.

On 26.3.45, cultures were made of the striped leaf tissue as described above and *X. vasculorum* was recovered.

g — *Summary of the inoculations with the reisolates.*

The identity of the reisolates obtained from the various plants inoculated was proved by inoculation into sugar cane blades, when definite stripes, characteristic of the gumming disease were produced. The work was effected and the observations made on the dates shown below.

PLATE VIII

Phots. 15 to 18 — Photomicrographs of vascular bundles from transverse sections of young parts of cabbage and leaf sheath of artifically infected young royal palms. Fixed in Carnoy's fluid and stained with carbol fuchsin, by Cottrell-Dormer's method (9). x 90. Ilf. Sp. Rapid Pan. plate. Phot. 1.6.45.

The plants were inoculated on 23.3.45. The photographs show bundles of various sizes with their xylem vessels blocked with gum ; the surrounding tissue was still healthy.

Phot. 19 — Photomicrograph of a portion of the central cylinder of the root of a young royal palm plant inoculated into the stem on 23.3.45 with the Roystonea pathogen (culture e_8). Root fixed 3 days in Carnoy ; sectioned and photographed on 4.6.45. x 90. Ilf. Sp. Rap. Pan. plate.

Note the metaxylem vessel blocked with bacterial gum. The separate strands above the stele show how the cortex of the root is divided into compartments (aerenchyma tissue) in the root of the royal palm plant.

PLATE VIII

TABLE V

Date of inoculation	Cane variety	Culture	Observations	
			Date	Results
23.3.45	55 P	e_8 Reisolate from maize	12.4.45	+
30.5.45	„	Roystonea reisolate	15.6.45	+
„	„	Thysanolæna reisolate	„	+
„	„	Coconut reisolate	„	+
3 9.45	55/1182	Dictyosperma reisolate	24.9.45	+

10 — Comparative study of isolates from the royal palm, sugar cane, white palm, and the " broom bamboo " grass.

An examination was made of certain of the cultural characters and physiological reactions of isolates from the royal palm (cultures e_8, R.B.G. 1,4,7, and variants of e_8), in parallel tests effected with fresh isolates from the sugar cane (cultures G and GR 4/46), the white palm (culture D. alb. a) and the broom bamboo or tiger-grass (cultures TML_1 and TMS_3). No salient differences were observed between them.

The tests were generally carried out with 20-24 hr. old transfers, using Bacto (Difco) media, and following the methods recommended by the Committee on Bacterial Technique of the Society of American Bacteriologists (19). Special technique was sometimes adopted which is described in the text.

The royal palm pathogen was observed to agree with the organism obtained from the other hosts in being a short Gram-negative rod, developing a single polar flagellum (Pl. VI, phot. 6). The colour of the cultures on Peptone-Saccharose agar varied from the light Naphthalene Yellow to darker shades as Naples Yellow, Chamois, and Honey Yellow (33).

A difference of colour was also noted depending upon the medium used ; thus on Bacto-Nutrient agar, the cultures were always slow-growing, about Wax Yellow and of a resinous appearance by transmitted light. The same cultures on Peptone-Saccharose (Wilbrink's) agar gave a thick, slimy growth flowing down the slant and of Naphthalene Yellow colour, a much lighter shade than the former.

The colour of the growths of the isolates from the other hosts as mentioned in our previous publication (26) were :

X. *vasculorum* from the sugar cane : From Naphthalene Yellow or Straw Yellow to Barium, Wax, Naples, and Mustard Yellows.

The white palm pathogen : From Naphthalene or Amber Yellow to Wax or Primuline Yellow.

The Thysanolaena pathogen : From Naphthalene Yellow to Marguerite and Amber Yellow.

The colonies on agar were circular, entire, convex, with a smooth surface, and generally of either a fine-granular or a grumose texture.

Carbohydrate requirements. — Cultures e_2 and G were tested on 26.2.45 and the remaining cultures on 5.10.45 in Bacto-Nutrient broth containing the ordinary common sugars. They gave neither acid nor gas. Upon our attention being drawn by Dr. Dowson to the fact that " if the sugars were incorporated in peptone a small quantity of acid would be neutralized by NH_4 compounds produced at the same time from the peptone " (letter from Dr S. P. Wiltshire dated 18th. Oct. 1926), we used the synthetic carbohydrate medium which he recommended to us (19) Leaflet II_{44}-14) and obtained the following results :

Acid from glucose, sucrose, lactose : GR4/46 ; $R.B.G_4$; D. alb. a ; $e_{...}$

Acid from glucose and sucrose only : TMS_3.

The other cultures were not tested on that occasion. No gas was produced from any of the carbohydrates.

Lipolytic reaction. — On February 12,1947, we were informed by Dr. Wiltshire that he had heard as follows from Dr. Dowson : " I selected four (cultures) for comparison with two strains recently sent me from America. The four Mauritius strains were those isolated from sugar cane (GR4/46), Dictyosperma (D. alb. 2), Thysanolæna (TMS. 3) and Roystonea (R.B.G.4). Of the American cultures one had been isolated from cane in Porto Rico in 1933, and the other from cane in Australia (N.S.W.) in March 1946. Both of these liquefied gelatine slowly ; but none of the four Mauritian strains showed any sign, and of the whole six cultures only the Porto Rico strain was actively lipolytic. The other five showed no sign of fat hydrolysis. In other respects the six cultures were similar ".

Upon request from the writer, Dr. Dowson forwarded to him notes on the method of preparation and mode of use of the medium used for determining the lipolytic activity of bacteria. Dr. Dowson remarked that " Spirit Blue (National Aniline).....seems to be the same as Night Blue (Gurr) as used by us. It is *not* the same as Aniline Blue (spirit soluble-Gurr or Grubler)".

At about the same time, the writer received a request for cultures of bacterial plant pathogens from Dr. M.P. Starr of Brooklyn College, New York. Accompanying the request was a batch of papers, in which we read of the work effected by Dr. Starr on the determination of the

lipolytic activity of bacteria, by the use of his Spirit Blue-cotton seed oil technique. Cultures of plant bacteria were forwarded to Dr. Starr on 5.12.46, and in a letter dated 25.6 47, he reported as follows :

" ... They arrived in the country having been in transit about two months, only to be intercepted by our quarantine officials. It took about a month of correspondence to receive the cultures from them. By that time, many of the cultures had perished and, despite my best efforts, I was able to revive only eight of them.

... They are all beyond question genuine Xanthomonas species, On Spirit Blue cotton seed oil agar, none of your eight cultures gives the " lipolytic " reaction ... The New South Wales culture is also negative to this test, but the old Porto Rico strain is still positive. "

Dr. Wiltshire had kindly supplied us with a small quantity of Night Blue (Gurr), but unfortunately we had no cotton seed oil, and up to the present, through the world shortage of oils, it has not been possible for us to obtain any. We therefore modified Starr's medium, using Kepler's cod liver oil (with malt extract), in spite of the fact that the oil was of animal origin. We thought it could be an advantage if a ready-prepared and easily available oil emulsion could be used for the test. We used a medium of the following composition : agar 20g. : Bacto-peptone 10g. ; Marmite (Yeast extract) 5g. ; Kepler's cod liver oil 5g. ; 0.3 o/o alcoholic Night Blue solution 50 ml. ; distilled water to 1000 mls. The colour of the prepared medium was still blue and it was necessary to add some Normal caustic soda solution to produce the Lavender colour which results when fresh cotton seed oil is used.

In the batch of cultures we tested, we included a coccus which we had isolated from newly dead *Physonota alutacea* larvae, and a culture of *Bacillus coli* which we had obtained from the Bacteriological Laboratary of the Medical and Health Department at Reduit. Both of these cultures produced in two days a wide blue zone around their growth ; our isolates from the various hosts made good growth, but their reaction was negative.

Action on Gelatine. This test was made on 3.8.45 with Bacto-Nutrient gelatine to which Bacto-gelatine had been added to increase the amount of the substance to 20 o/o, but growth was so poor that the medium was not considered suitable for the organism. On 19.5.45, tubes of Peptone-Saccharose (Wilbrink's) medium, with 20 o/o gelatine ins ead of the agar were inoculated with G, e_8, and two reisolates of e_8 from Roystonea and Thysanolæna. On 28.5.45, a slight crateriform depression had been formed at the inoculated centre in the tubes ; the power of liquefying gelatine was therefore considered to have been proved and no further observations were made.

On 4.10.46, tubes of the same P. Saccharose 20 o/o gelatine m dium were inoculated with R.B.G. 1, and 7, TMS_3, TML_1, GR4/46 and e_8, and in order to prevent the drying out of the medium, the culture tubes were placed standing in a beaker on a vaselined glass plate under a bell jar,

along with unp ugged tubes of sterile water. The glass plate, the beaker and the inside of the bell jar had been sterilized with alcohol and flamed.

On 15.10.46, i.e. after eleven days, liquefaction had started in all the cultures save TML_1 and TMS_3, and on 18.11.46 or after forty-five days, about one-third of the medium had been liquefied. Liquefaction started in the T-cultures on 24.10.46, or after twenty days, and after forty-five days the action was observable only as a tear on tilting the tubes.

On 12.2.47, Dr Dowson reported, as already said, that " none of the Mauritius strains showed any sign (of liquefaction) ". The above-mentioned observations were therefore communicated to him, and on 28.3.47, Dr. Dowson commented as follows : " ..... the presence of the saccharose in the gelatine may account for the liquefaction as the six strains I examined all produced acid from this sugar..... "

The writer has, unfortunately, been unable to repeat the test as indicated.

Action on starch. In a test carried out on 26.2.45 with e_8 and G cultures, hydrolysis was detected after twenty-four hours and was complete in seven days. The other cultures were tested on 5.10.46, when hydrolysis was complete after ten days, save in the T-cultures, in which the action was nearly complete after 20 days. In our previous work (26) we noted about the hydrolysis of starch that " the Thysanolæna bacterium is much slower than the other two in this respect ", i.e. than the sugar cane and white palm isolates.

Action on nitrates. The first cultures with e_8 and G, made on 26.2.45 in Nutrient broth + 0.1 o/o KNO_3 were tested with sulphanilic and alpha-naphthylamine on 2.3., 5.3., 12.3., 19.3. and 19.5.45. The second series with the remaining cultures were made on 5.10.46, and tested on 15.10., 25.10., 4.11. and 11.11.46. No reduction of the nitrate was detected. A little zinc dust added to the tubes after each test showed the nitrate to be still present.

Milk reactions. Clearing was observed after 24 hours in some cultures and 48 hours in others; it started after several days in the T-cultures and progressed in these latter much more slowly than in the others.

The colour of the medium by transmitted light after 91 days was as follows :

TABLE VI

		Skimmed Milk	Litmus Milk	Brom-cresol-purple Milk
Control		Ivory Yellow	Pale Lavender Violet	Light Olive Gray
e_8	clear part at top	Light Orange Yellow	Vinaceous Lilac to Light Ochraceous Buff	Rocellin Purple
	translucent part	Light Ochraceous Buff	Vinaceous Buff	
G	clear part	Deep Chrome	Deep Purplish Vinaceous	Vernonia Purple
	translucent part	Ochraceous Buff	Vinaceous Buff	

11 — Discussion.

The name bud rot: We published a Preliminary Report on the bud rot of the royal palm in the island in 1945 (31), but as we have stated in the course of the present work, we have not personally witnessed the early stages of the disease on the plant, and we have been postponing the publication of our study, in the hope that new cases of the disease would have occurred meanwhile; but as none has been reported since, we must apologize if we are not in a position yet to speak of the beginning of the attack on the plant. We fortunately have, however, Edwards' brief reference to the condition of the crown of the diseased tree which was sent to the Imperial Bureau of Mycology in 1928 (see page 231) and Ashby's description of the internal symptoms which the cabbage displayed (p. 229).

According to Edwards, the first signs of the disease are a slight stunting of the younger leaves (meaning evidently the innermost whorl of young leaves) and their erect position amidst the leaves of the crown. No mention is made of a collapse or a wilting of the spindle itself and had there been one, we can take it that Edwards would have mentioned it without fail. We must remark that he went into the trouble of comparing the relative lengths of the young leaves of healthy and of diseased trees, to note that in the latter, these leaves were stunted. Ashby on his part stated that the bud which he examined was still unaffected. Thus on that tree which showed *outwardly* signs of being diseased, "the actual growing point and the leaf primordia immediately investing it were however free from rot" (see page 229). We can take it for granted then that with the royal palm disease caused by *X. vasculorum*, the first outward symptom indicating the diseased condition of the tree is not, at least generally, the collapse of the spindle of heart leaves. In the cases we studied in 1944, we observed that the wilt of the leaves was far advanced when the heart leaf began to dry out. We have therefore to ask ourselves whether the name of "bud rot", to characterize the disease, is justified in the present instance.

Indeed, Butler, Ashby and others (15) have stated that for a disease of palms to be a primary bud rot, the heart leaf pushing out should be the first to collapse of the leaves of the crown. The Xanthomonas disease on *Dictyosperma album* seems to be primarily a leaf disease as the writer pointed out rather recently (30), in spite of his earlier contrary opinion (26, 28); the disease on that plant appears to begin by a blight of the leaves and to end in a bud rot, years afterwards. We have, however, encountered a few cases of disease on the white palm in which the spindle was the first to fail, but we feel that we must await still further observations before being able to make definite conclusions.

Should it, however, be argued from what we have said that our palm disease cannot be reckoned to be a primary bud rot, we shall point out that in the bud rot category of palm diseases, the Mauritius disease stands

in quite a peculiar position. It cannot be denied that in the present case, the pathogen slowly works its way to the growing regions, where it finally sets up a rot of the tissues. Putrefactive organisms follow in its wake and bring about the foul decomposition so well known to students in this field ; but the primary agent of destruction is *X. vasculorum*. Hence, if the disease is not a primary bud rot because the heart leaf is not the primary leaf to collapse, it is well nigh primary in that the organism does itself set up the *initial* decomposition which results in the death of the tree.

Furthermore Nowell (24) stated that " evidence of infectiousness is necessary to establish the existence in any given situation of a specific bud rot disease ". In the present case, the potentialities of *X. vasculorum* as an infectious agent are well-known, and the bud rot of palms which it causes cannot be reckoned other than a specific bud rot.

When a specific organism attacks such a plant as the palm tree, which of the young or old leaves of the crown will show symptoms of disease first, depends on the relative speed with which the organism can reach the growing region. With Phytophthora, the attack starts in the axils of the outer leaf sheaths, the parenchyma tissues collapse rapidly and the pathogen travels in a sort of lateral bee-line to the heart. In the case of *X. vasculorum*, the writer considers that the disease begins in the leaves, although he has yet no absolute proof to offer about it. The pathogen then takes a very long time to travel inside the vascular bundles before reaching the young tissues of the plant. The outer leaves, meanwhile, show either by a blight or a wilt indications that the plant is infected. The progress of the disease is rapid in one case and the young leaves collapse first, while it is slow in the other and the outer leaves indicate the diseased condition of the tree before the heart leaves do so. Ashby said (3) that the Phytophthora bud rot was the nearest approach yet found to a primary bud rot of palms. What then should be the status of the Xanthomonas disease, where the pathogen is led without chance of error by way of the very vessels of the plant to the actual growing region ?

The bud rot of palms caused by *X. vasculorum* is therefore theoretically " a specific primary bud rot " ; but considering its slow evolution, there may be sufficient grounds for discarding the name of bud rot in this case and to use some other name, such as " Xanthomonas Wilt ", which the writer would be prone to propose in this connection. Indeed, to speak of a disease of the bud when that bud is still quite sound (cf. Ashby's observations, page 229), and only the leaves are somehow affected, seems somewhat a stretched proposition.

Nevertheless, we shall, for the time being, leave the question open ; we provisionally keep the name " bud rot " for the Mauritian palm disease and await further observations before definitely proposing the name by which it should be known.

The production of variants. The production of variants in culture by *X. vasculorum* from the sugar cane was mentioned by North (21) who considers them to be of a stable nature. During the course of his researches,

the writer has obtained some evidence tending to show that variants may also be obtained from subcultures, which are to some extent unstable in character.

In Mauritius, no difference has been observed between the isolates from sugar cane and from the white and the royal palms; but there are certain apparently fixed differences between them and the Thysanolæna pathogen which may perhaps be sufficient to class the latter, if not as a different variety of the organism as Ashby (4) considered to exist, yet as one of the fixed variants referred to by North. Thus it liquifies gelatine (in presence of sucrose; see Dowson's remarks, p. 250) much more slowly than does *X. vasculorum* from cane and from palms, so also are the action on starch and on milk, and on the last medium, the final colour reactions perhaps indicate some real difference between them. The particular strain of the pathogen on *T. maxima*, if it is really one, may however exist on sugar cane in other countries, or may perhaps be seen in the future to be already present on the sugar cane in the island.

The hydrolysis of fats. Dowson and Starr in correspondence with the writer have drawn attention to the fact that *X. vasculorum* obtained from sugar cane in Porto Rico is positively lipolytic, whereas the pathogen from sugar cane both in Mauritius and Australia and the isolates from palms and Thysanolæna in Mauritius have no action on fats. The difference may be an important one, perhaps indicating definitely the existence of different strains, or even varieties, of the pathogen. Considering the similarity in this respect between the Mauritian and Australian isolates, Dowson wrote to Dr. Wilshire that "one might hazard the suggestion that Mauritius received its present *X. vasculorum* from Australia rather than from America". Inasmuch, however as the bulk of the traffic in the exchange of sugar cane varieties occurred in the direction Mauritius to Australia, the writer believes that the chances are that it is Mauritius which passed its strain of *X. vasculorum* on to Australia. The question would remain open, however, as to where the Mauritius strain of the pathogen came from, or how it originated. In a letter dated 25 June 1947, Starr wrote: "I am not prepared to say that this (the lipolytic behaviour of *X. vasculorum*) indicates that Mauritius got its infected cane from Australia". The lypolitic reaction of the pathogen should perhaps throw much light upon the migrations of *X. vasculorum* in the world, and it would be desirable that the gumming organism be examined for its action on fats in all sugar cane growing countries where the organism occurs.

Variable susceptibility of different palms. The inoculations carried out on palms have shown that the coconut plant, although susceptible to artificial inoculation with the sugar cane bacterium, yet shows a greater resistance to the disease than the other palms tested. Indeed although coconut seedlings died after a few months, when inoculated by the writer in 1937 (26, 28), none of the tall plants inoculated in 1915 has yet died; recovery from the infection being even indicated at the time of writing. This would tend to show that different palms vary as to their suscep-

tibility towards the pathogen, as should be expected. Upon the basis of field observation, Roystonea regia would be the palm most susceptible to *X. vasculorum*, the Dictyosperma palm coming next in degree of susceptibility.

The importance of the existence of natural hosts of X. vasculorum. Up to 1937, no plant other than the sugar cane was known to harbour the sugar cane gumming disease pathogen in nature. We have found that maize, the white palm (or Princess palm), the royal palm and the grass Thysanolæna act as natural host plants of the organism in Mauritius. At the time of writing, yet a third palm is being studied as most probably also harbouring the pathogen.

On the susceptible sugar cane varieties of the past, gumming often resulted in devastating epidemics (21), which in many cases brought the sugar cane industry to the verge of ruin. The gradual replacement of the susceptible varieties by other more resistant ones saved the industry as a whole, but without doubt, the disease brought about or helped to bring about the downfall of many an individual planter.

Through the pioneer work of North in Australia (21), sugar cane growers were given a method for testing the resistance of new cane varieties, before their cultivation on the field scale. By the continued planting solely of highly resistant varieties, North succeeded in eradicating the gumming disease in Fiji and apparently also from certain districts in Australia. The success of the method depended upon the absence in the country of hosts plants other than the sugar cane which would act as foci for the start of new infection when susceptible, but otherwise desirable varieties would again be planted later.

North could not understand the continued presence of the disease on cane in Mauritius, and he states (21):

" The prevalence of Gumming for so many years in Mauritius, and the absence of any tendency for it to become extinct as it has done elsewhere, is evidently attributable to several of their so-called " resistant " varieties (M 55 and other seedlings) being of the susceptible but tolerant type and acting as carriers ".

In 1930, Shepherd was sent by the Government of Mauritius to Australia, one of the chief objects of his visit being to study North's method for testing the resistance of sugar cane varieties to the gumming disease, and in the report he submitted on his return he wrote (40):

" The following statement by M. T. Cook with regard to gumming in Porto Rico has special interest in this connection : " So long as this disease exists on the island it will be a dangerous factor in the development of a new desirable but susceptible variety. " This statement is equally applicable to conditions in Mauritius. The general application of the above-mentioned measures of control against gumming as practised and found effective in Australia should in the course of a short time result in the extinction of the disease in Mauritius.

There will thus be eliminated from the colony an important factor which has prevented in the past and threatens to prevent in the future the propagation of certain high quality locally raised and imported cane varieties",

North's method of control has been applied in Mauritius, but from 1937 onwards, the writer proved the existence of the disease in the island on the various hosts mentioned. These discoveries have charged the outlook about the future of the disease in Mauritius. Its complete eradication is impossible because some of its hosts are growing wild here, and its only means of control with us is the continued planting of resistant or immune varieties. Even though some susceptible sugar cane variety should be produced in the future with qualities far surpassing those of the varieties which would be under cultivation, it would perhaps mean living back the days of the epidemics of old, were the cultivation of that variety effected on a large scale in the island.

Indeed many of the new cane varieties produced by our Sugar Cane Research Station are rejected every year through their failing to pass the routine Gumming Resistance trial to which they are submitted, and among the varieties so discarded, many were those which otherwise offered brilliant prospects. The presence of the natural hosts of the gumming disease in the island may therefore perhaps even actually, mean a loss to the sugar industry of the island.

12 — Summary.

In the present work the writer recalls that the chief type of palm bud rot of epidemic nature was generally recognized as being caused by the fungus *Phytophthora palmivora* Butler. Johnston's contention that bud rot of the coconut palm in Cuba was due to bacteria of the *Bacillus coli* group was not accepted, the concensus of opinion being that the bacteria always present in budrotted palms were only secondary invaders and that a primary bud rot of palms did not probably exist.

In 1937, the writer proved that a bud rot of the white palm, *Dictyosperma album* Wendl. and Drude, occurring in Mauritius was caused by the sugar cane gumming disease bacterium *Xanthomonas vasculorum* (Cobb) Dowson, and in the present study proof is brought forward that the bud rot of the royal palm in the island is also caused by the same organism. Mention is made of the previous researches of the writer which proved that maize and the grass *Thysanolæna maxima* (Roxb.) O. Kuntze were also natural hosts of the pathogen.

The results of cross-inoculation work with isolates from the royal palm, the white palm, the Thysanolæna grass, and with *X. vasculorum* from the sugar cane on the various hosts are given, and mention is made of some comparative cultural studies effected with the various isolates.

At the end of the paper, the following points are discussed : the appro-

priateness of the term "bud rot" applied to the Xanthomonas disease of palms, the production of variants by the organism, the possible importance of its lipolytic action, the variable susceptibility of different palms to the disease, and the importance to the local sugar industry of the presence in the island of a number of natural hosts of the organism.

13 — Acknowledgements.

Before ending this work, it is the pleasant duty of the writer to tender his thanks to Dr. S. P. Wiltshire, Director of The Imperial Mycological Institute, who enlisted the precious help of Dr W. J. Dowson, of the Cambridge University, for a laboratory study of the isolates forwarded by the writer, and maintained for some considerable time contact between Dr. Dowson and him.

He wishes especially to record his indebtedness to Dr. Dowson for the determinations he made, which are specified in the course of the present work, and for precious suggestions about modifications in technique.

He extends his thanks to Dr. M. P. Starr, of Brooklyn College, New York, who sent him details about the lipolytic action of his isolates, to Mr. P. O. Wiehe, M.Sc., A.R.C.S., F.L.S., Plant Pathologist of the Department of Agriculture, Mauritius, who made many useful suggestions to the writer during the course of his researches, and to Mr. E. Rochecouste, Ag. Plant Inspctor, for his help chiefly during the inoculation part of the investigations.

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CHEMICAL CONTROL NOTES

SERGE STAUB

The exhaustion of final molasses.

It would seem that the importance of the exhaustion of molasses is not fully appreciated in Mauritius. Final molasses of several factories show purities of 42° to 45° whereas it is possible for these factories, without any major modification or addition to existing plant to have molasses of 36° to 38° purity which should be considered as the reasonable maximum.

For a factory crushing 80.000 tons of canes in one season, if we reckon 2.7 o/o of molasses of 92° Brix on weight of canes, it is easy to show that 1° of molasses purity is equivalent to about 20 tons of sugar.

The obtention of well exhausted final molasses will be made easy with the help of electrical conductivity and microscope control ; but of course much will depend upon the chief pansman who should be a fully trained, competent and responsible person preferably with academic qualifications. A simple calculation will show that salaries of Rs. 500 or more per month for such an employee are quite reasonable in view of results which he could show.

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Vat bottoms are centrifugalled in a 30 × 14 machine at 1200 r.p.m. The basket of the machine is fitted with a canvas backing instead of the usual perforated screen. The vat bottoms are pumped into a receiving tank from which they are fed to the centrifugal by gravity. The basket is charged in motion until half full and spun for about 10 minutes and when the centrifugal is stopped the liquid falls to the discharge and the sludge scraped into sliding wooden trays from which it is transfered into tubs where it is allowed to accumulate. Finally the sludge is dried in the sun. The total area of the drying platform being 540 square feet.

The thickness of the sludge layer on the platform is originally about 1" is about $\frac{1}{4}$" after drying. The dried yeast is then powdered into a corn mill. The labour required is one man per shift for curing and two men working one shift per day for handling the cured yeast.

The dried yeast obtained was 670 grams per hectolitre of waste and the centrifugal was capable of turning out about 125 kgs of dry yeast per 24 hours.

The protein and ash contents of samples taken at different periods showed considerable variation ; however the keeping qualities of the produce were good. After 4 to 5 months storage in kerosene tins samples gave the following average composition.

Moisture	...	...	...	13.3 o/o
Protein	...	...	...	19.5 o/o
Ash	...	...	...	25.0 o/o

The produce was fed to cattle and pigs with excellent results. Tests carried out proved conclusively that the yeast when added in proportion of 5 o/o to the ration caused a greater increase in weight of growing pigs and calves. In the case of calves the effect is even more beneficial when added up to 10 o/o.

S. S.

MAURITIUS HEMP PRODUCERS' SYNDICATE

Rapport du Président pour l'année 1946.

MESSIEURS,

J'ai l'honneur de vous présenter mon Rapport pour l'année 1946, ainsi que l'état de situation arrêté au 31 Décembre dernier.

Pendant l'année écoulée, il a été livré à la Sacherie gouvernementale 710 tonnes de fibres, et il a été employé 789 tonnes, en utilisant le stock disponible au 1er Janvier 1946.

L'usine a produit :	... ...	905.000 Sacs de contenance de 50 kilos de sucre
Toile à filtre-presse	... ...	87.000 Yards
Fils sur embobinés pour cordages et ficelles		45.500 Kilos

Le prix obtenu pour les sacs a été de R. 0.57 cs. l'un, prix basé sur des sacs de jute de même contenance, commandés de l'Inde par le Syndicat des sucres en 1945, ces sacs ne purent nous parvenir qu'en Janvier 1947. Faute de moyens de transport !

Le prix de la toile à filtre-presse a été de R. 0.03½ cs. par pouce yard (largeur de 20" = 0.70 cs. le yard).

Les fils embobinés pour la fabrication locale des cordages et ficelles ont été vendus sur la base de Rs. 625.— la tonne. Il va sans dire, que les prix payés pour nos sacs l'an dernier seront la cause d'une perte sensible pour la G. S. F.; mais suivant les conditions qui régissent ces transactions, c'est à dire que les sacs locaux doivent obtenir le même prix pratiqué pour les sacs de jute à l'importation, les sacs qui seront reçus pour la coupe 1947/48 coûteront, paraît-il, beaucoup plus cher, ce qui viendra compenser la perte subie l'an dernier.

Les maisons de commerce, tout comme le G.S.F. ont reçu des offres très alléchantes pour nos sacs en fibres d'aloës, mais l'exportation en étant prohibée, ces offres n'ont pu être prises en considération ; ce qui prouve que même plus tard, s'il se manifestait une concurrence pour les sacs, nous pourrions aisément nous créer un marché très important et à des prix plus rémunérateurs à l'étranger.

Dernièrement un comité avait été formé dans le but de s'occuper d'une exposition de tout ce que Maurice pouvait produire, cette exposition devait avoir lieu au Caire, mais pour des raisons inconnues de nous, elle n'a pu avoir lieu jusqu'ici, une récente communication du Secrétariat nous informe qu'elle se tiendra au British Industries Fair cette année, c'est là, une heureuse initiative, et nos fibres et les autres articles fabriqués avec nos fibres, seront en bonne posture et feront excellente figure, nous en sommes persuadé.

Il a été exporté une cinquantaine de tonnes de fibres de Sisal au début de cette année ainsi que du fil préparé qui, dit-on, servira comme " binding twine ".

Le prix qui est offert pour du Sisal de notre provenance, aussi bien que le " Fourcroya " est très élevé, nos fibres naturellement auraient pu jouir en Europe d'un marché supérieur à celui régissant les fibres contingentées de l'Est Afrique. — L'autorisation d'exporter une certaine quantité de " Sisal " a été obtenue, pour la raison que ces fibres ne peuvent être tissées par le G. S. F., et ne servent ici que pour les ficelles et cordages, il est question d'utiliser le Sisal pour les toiles à filtre-presse. Quant au " Fourcroya " comme vous le savez, l'exportation en est prohibée totalement.

Le prix coté pour ces fibres était dans les environs de £ 100— par tonne en Europe, ce chiffre est loin des Rs. 550.— que nous obtenons pour nos fibres localement ; ceci pour faire ressortir une fois de plus, que les filateurs se rendent compte, qu'en vendant leurs fibres pour une utilisation locale, ils bâtissent pour l'avenir, que leur but d'implanter l'Industrie de la manufacture des Sacs avec nos fibres " Fourcroya " est d'établir une base saine, afin d'être assurés d'un avenir stable et pouvoir réaliser bon an mal an un profit raisonnable.

Non seulement les filateurs ont pu ainsi aider d'une manière tangible l'Industrie Sucrière, mais ils vont permettre également au G.S.F. de pouvoir, à un moment déterminé, se libérer entièrement envers le Gouvernement en capital et intérêts, tant pour l'argent avancé par le Colonial and Development Fund pour doter la Sacherie de nouvelles machineries et compléter celles qui faisaient défaut, lors du lancement du M.S. & W.C.L. que pour le remboursement intégral de la faisance-valoir.

Et malgré cet esprit de sacrifice, toutes les doléances des filateurs sont restées lettres mortes auprès du Gouvernement. Des résolutions votées à l'unanimité des membres du M. H. P. S. ont été ignorées, et comme beaucoup d'entre vous ne sont pas en possession d'une copie des résolutions votées, entre autres, celles votées à l'assemblée générale tenue le 8 Février 1946, je pense qu'il est opportun de l'insérer dans ce rapport, ainsi que la réponse négative reçue du gouvernement :

MAURITIUS HEMP PRODUCERS' SYNDICATE.

Port-Louis,
8 February 1946.

His Excellency
Sir H. C. Donald Mackenzie-Kennedy, K.C.M.G.,
Governor & Commander-in-Chief of Mauritius & its Dependencies
&c &c &c
Port-Louis.

Your Excellency,

On behalf of the Members of the Mauritius Hemp Producers' Syndi-

cate. I have the honour to submit to your considerate attention the following resolutions which were unanimously voted at our General Meeting held to-day at the Chamber of Agriculture.

1. The Mauritius Fibre Industry, as well as its staple industry — Sugar — have sustained considerable damage through the three cyclones which visited the Island in the factors, such as difficulty of transport, increased cost of labour, sorting of damaged leaves in the fields and at the factories, has considerably handicapped some Producers who have been working at a loss during the whole of last year, in order to keep on supplying fibre to the Government Sack Factory.

2. In the circumstances, Hemp Producers consider that they would be entitled, and justified, to seek a grant-in-aid from Government to enable them, at least, to make both ends meet.

Such financial help would not entail a considerable burden on Government.

Fibre Producers have, this year, contracted with the Sack Factory on the basis of **Rs 500,--** per ton of fibre delivered at Quatre-Bornes, but they could not obtain a retroactive effect on the price paid last year, which was **Rs 450. —** per ton.

Producers estimate that, if Government could see its way to grant them a compensation of, say, **Rs 50. —** per ton of fibre delivered to the Sack Factory during the whole of 1945, such grant would relieve to some extent those who have suffered losses during the period under review.

The quantity of fibre, delivered to the Sack Factory in 1945, did not exceed **750 tons**, the amount at stake will therefore be in the neighbourhood of **Rs 37,500 —.**

I should mention at this juncture, that this cyclone which visited the Island on 30/31st January, this year, caused considerable damage to the western districts, which are the principal suppliers of aloe fibre. This will mean a further handicap to those producers who are most in need of help and this should not be lost sight of by Government when studying the possibility of aiding the Hemp Industry.

3o. Another grave problem, which is at present retaining the attention of the Department of Agriculture, is that of the "Herbe Condé" which is spreading with such rapidity that adequate means of destroying this pest must be discovered before irretrievable harm can come out of it. Mr. Ocreve Wiehe is understood to be on the right track of finding the proper parasite for the above pest, which, under control, will allow Hemp Producers to envisage the necessity of increasing their aloe plantations, in view of copying with the increasing demand of the Sugar Industry for bagging material.

4o. The prospect should prove most advantageous to the Colony from an economic point of view, and encounters the Secretary of States Policy of promoting the Colony's secondary industries.

5o. It must not be lost sight that our Hemp industry has always been second in importance after sugar, a rank which it must not relinquish as

it affords employment to a large section of the community, and even more labour could be employed in the industry's contemplated extension.

6o. Whilst on the question of increasing our fibre production, I would mention that producers are following with keen interest the experiments that are now being carried out, and it is to be expected that, in a not very distant future, they will be afforded all possible guidance as to the suitable variety of aloe plant to cultivate on a large scale, both from the point of view of quality for weaving purposes, as well as yield in the fields and at the Sack Factory.

7o. Producers have likewise learnt that new decorticators, of local design, and erected under the auspices of the Department of Agriculture, are now being experimented upon, and reports on their performance are awaited with interest.

8o. There is no doubt that, with the proposed extension of cultivation, the lowering of the cost of production by the use of new automatic decorticators, the construction of good roads, and the availability of cheaper means of transportation, the Mauritius Fibre Industry, with the advice and financial help of Government, may face the future with confidence and optimism.

9o. It is a recognised fact that aloe fibre bags are superior to jute bags in every respect, but should it happen that the latter be able, at some time or other, to complete against the local product on a question of price, it is quite likely that a suitable market could be found elsewhere for our sack, which, according to our information, are fetching a much higher price in the U. K., in comparison with the other second-hand bags having contained sugar.

Commending the above to Your Excellency's considerate attention,

I have the honour to be,

Your Excellency's most obedient servant,

(S) R. MAINGARD,
Président
MAURITIUS HEMP PRODUCERS' SYNDICATE.

COPY

4662/41

From: The Colonial Secretary
To: The Director of Agriculture.
Subject: Grant to cover cyclone damage.

(Communicated to the M.H.P.S.) 18.6.46.

SIR,

With reference to your letter of the 13th May, 1946, on the above subject, I am directed to inform you that Government is not prepared at

the moment to produce a grant-in-aid to Hemp Producers but that steps are being taken to obtain the services of an officer from abroad to advise on the general question of fibre cultivation including the economics of the industry.

(Sgd) R. R. CAMPBELL,
for Colonial Secretary.

(à remarquer la lettre adressée par M. H. P. S. est datée du 8 Février/46 après le " Reminder " du Directeur du Département d'Agriculture le 13 Mai, la réponse du Secrétariat est datée du 18 Juin).

Herbe Condé. Si, comme nous l'avions préconisé depuis nombre d'années avant la grande guerre No 2, des recherches avaient été faites, on aurait pu depuis longtemps déjà enrayer l'extension de l'herbe condé à Maurice, au lieu de cela on avait même émis l'opinion qu'on devrait la propager afin que les fleurs puissent servir de nourriture aux parasites introduits pour la destruction du " Moutouc " le " Phytalus Smithi " causant des ravages considérables aux plantations de cannes à sucre, aujourd'hui on doit bien se rendre compte en haut lieu, que le remède a été pire que le mal, le condé s'est répandu dans toute l'île et menace de ruines les petits planteurs et les producteurs de fibres. Heureusement, qu'on s'en est enfin ému ! Et Monsieur Octave Wiehe que nous avons eu le plaisir d'interviewer après son retour de Trinidad, où il avait été spécialement en Mission Scientifique, et aussi pour obtenir des produits parasites afin de se rendre maître de cette peste, nous a laissé entendre qu'il y avait tout lieu d'espérer, naturellement dans un avenir assez long, pouvoir détruire le condé — depuis, nous avons eu le plaisir de le revoir, et les parasites introduits par la voie des airs (par des avions de Air-France) viennent très bien, sont très prolifiques, et ne s'attaquent qu'aux feuilles de condé, de sorte que bientôt, nous l'espérons, ces parasites pourront être propagés dans toute l'île. Nous sommes redevables également à Monsieur Montia du Département d'Agriculture, qui nous a aimablement fait visiter le " Shed " Spécial où se trouvent les parasites et nous a donné toutes les explications susceptibles de nous intéresser. Il ne faudrait pas que l'on s'arrête en si bon chemin, nous avons déduit de l'intéressante conférence de Monsieur Octave Wiehe, qu'il existe d'autres parasites qui s'attaquent aux fleurs, et à l'écorce de l'arbre, il serait intéressant qu'on en fasse venir sans plus tarder, et nous souhaitons ardemment tout le succès possible à ces Messieurs dans leurs expériences et recherches.

Le condé est essentiellement un des facteurs prépondérants entravant l'augmentation de la production des fibres ; sans cette plante nuisible les filateurs auraient déjà pris des dispositions pour étendre leurs plantations et exploiter celles existantes, mais qui sont malheureusement envahies par une végétation luxuriante d'herbe condé, il est à remarquer que le district où se trouve la plus forte quantité de plants d'agave, et celui où le condé se propage davantage, c'est à penser que cette plante a trouvé là sa terre de prédilection !

Il est intéressant de lire la lettre que nous a adressée l'Hon. Bodkin, quand il était Directeur du Département d'Agriculture à Maurice, en réponse à nos revendications :

" I can assure you however that as far as I am concerned, no stone has been left unturned in an effort to secure immediate action. Once more permit me to assure you that the gravity of the situation is very fully appreciated both by myself and my staff, and that they are just as anxious as the planting community, to see this dangerous pest under strict control."

D'un côté, si nous disons que le condé a été un des facteurs entravant l'augmentation de la production des fibres, nous devons malheureusement ajouter que notre Industrie a été ignorée pendant des lustres par le Gouvernement, aussi bien que par l'Industrie Sucrière, nous n'avons jamais reçu l'aide efficace que nous étions en droit d'attendre ! Ce n'est que pendant les années de guerre, qu'on a pu se rendre compte du bien-fondé de nos justes revendications et des avantages considérables qui en découleraient, si le pays pouvait subvenir aux besoins d'ensachage des produits de notre Industrie Mère, et aujourd'hui plus que jamais, les événements qui se produisirent dans l'Inde récemment nous donnent entièrement raison.

Une communication, excessivement intéressante, vient d'être faite par Sir Philippe Raffray, K.T., C.B.E., K.C., concernant notre industrie.

La Chambre d'Agriculture, à qui la communication fut faite, nous a aimablement transmis l'extrait de la lettre de Sir Philippe concernant nos fibres. Nous ne pouvons mieux faire que de l'inclure dans ce Rapport, ainsi que la correspondance échangée de ce chef :

MAURITIUS CHAMBER OF AGRICULTURE

Port-Louis, 29th April, 1947.
No. H/1.

The President,
The Mauritius Hemp Producers' Syndicate,
Port Louis.

DEAR SIR,

I have pleasure in enclosing herewith an extract from a letter of Sir Philippe Raffray concerning the local fibre industry. This letter was addressed to the President of the Chamber of Agriculture and it is hoped that the passage enclosed may be of interest to you.

I would add that you make of the information contained in it whatever use you may think expedient.

Yours faithfully,

A. GUY SAUZIER,
Co-Secretary,
MAURITIUS CHAMBER OF AGRICULTURE.

CJT/MC.

Extract from letter from Sir Philippe Raffray C.B.E., K.C. No. P/5 7.3.47.

Mauritius Fibre Industry.

I received, last week, an invitation to a Conference at the Colonial Office to discuss the Fibre Industry of Mauritius.

The Conference took place on Wednesday, the 5th of March. It was presided over by Mr Monson and there were present Mr Monson's Assistant, Mr J. R. Furlong, Ph.D., A.I.C, of the Plant Department of the Imperial Institute (one of the vice principals) and myself.

Mr Monson explained that the object of the Meeting was to examine the possibilities of the extension of the Fibre Industry in Mauritius, more particularly in connection with the manufacture of bags for the packing of our sugars.

In this connection I refer you to my letter No. P/3 of the 21st February last.

I was asked to give a history of the whole question and Mr Furlong stated that the Colonial Office would have to select a suitable person to go to Mauritius and examine the position. I know that H.E. the Governor has been trying to obtain someone for the last two years for this purpose. Mr Furlong stated that the right type of man must be found, even if it were to take time as it was useless just to send anyone.

He further stated that Mauritius fibre had a bad name on the London Market being of very inferior quality.

He considered that there was now a great demand for the soft fibre as produced in the Colony, provided it be of the proper quality.

I handed over to Mr Furlong, Mr Raoul Raffray's Report on the Fibre Bag Factory. Mr Furlong will now try to find a suitable person, and if he does as he believes he will, we shall have a further discussion on the matter and an interview with the candidate.

Mr Furlong was very anxious to see some of our bags and I am now trying to find some in London to show him.

Extract from letter from Sir Philippe Raffray C.B.E., K.C. No. P/3 of 21.2.47.

I gave to Mr Forster a full account of our attempts to develop the Fibre Bags Factory in Mauritius, and of the lack of encouragement and of assistance we had received from the Colonial Office, during my mission to London in 1945. H.E. The Governor and myself were then faced with an absolute "non possumus" and we entirely failed to convince the Government — more particularly Sir Frank Stockdale, and Sir Gerald Clauson — of the advantages for Mauritius to make its own bags.

There is a different story now with the change of conditions in India. Mr. Forster stated that the Government was now examining the extension of Fibre production in the Colonies to replace jute, for which we are entirely dependent of India. He would take up again this question of Mauritius Fibre bags with the Colonial Office.

MAURITIUS HEMP PRODUCERS SYNDICATE

Port-Louis, 2nd May 1947.

The Secretary
Mauritius Chamber of Agriculture,
PORT-LOUIS.

Dear Sir,

I thank you for communicating to me extract from a letter addressed to the President Mauritius Chamber of Agriculture by Sir Philippe Raffray, in connection with the local Fibre Industry.

I hope that the interview Sir Philippe had with Mr Monson, at the Colonial Office, on the subject of our Hemp Industry, will pave the way to an extension and improvement of fibre production in this Colony.

Had the Mauritius Hemp Industry been receiving the assistance, and guidance, which I have consistently been advocating during the many years I have been presiding the Hemp Producers Syndicate, I am positive that the Sack Factory would now be in a position to supply the bulk, if not the entire quantity of sacks required by the Colony's staple Industry.

There is no doubt however, that, with a speedy eradication of the "Herbe Condé" pest, and a suitable assistance from the Development Fund & the Industrial Welfare Plan as already advocated, the local fibre industry may recover, and prosper, for the benefit of all concerned, and more particularly the Sugar Industry.

I remain, Dear Sir,
Yours faithfully,

J. RENÉ MAINGARD
President : MAURITIUS HEMP PRODUCERS' SYNDICATE.

Nous devons déduire de ce qui précède, que Sir Philippe ainsi que ces messieurs du Colonial Office, sont d'opinion que l'on devrait sans plus

tarder s'occuper d'accroître les plantations d'agave pour augmenter notre production des fibres.

Donc pour tisser les toiles il faut employer le " Fourcroya ". C'est le " Soft fibre " dont fait mention Sir Philippe, il faut donc se mettre à l'œuvre immédiatement et avec l'aide du " Development & Welfare Scheme " rien ne serait plus facile pour le Gouvernement de venir en aide aux filateurs — faudrait-il attendre l'arrivée de l'Expert, dont parle le Secrétariat, pour mettre à exécution un plan de réforme pour notre Industrie ! Nous attendons donc les directives que voudra bien nous donner le Gouvernement.

Les expériences faites à la Société de Roches-Brunes concernant les plantations d'" agaves ", " Fourcroya ", " Sisal ", " Aga Amaniensis " ont été suivies par des Membres du Staff du Département de l'Agriculture, ce qui a eu pour résultat, un rapport de MM. Coombes et d'Emmerez de Charmoy, nous devons les féliciter tous deux des renseignements techniques y contenus, mais malheureusement aucune certitude n'est donnée en ce qui concerne une solution pratique et définitive, savoir l'agave qu'il faut propager — nous revenons à nos moutons et préconisons d'après l'expérience acquise, des plantations de " Fourcroya " pour la fabrication des sacs, et le " Sisal " pour l'exportation et la fabrication des cordages ; et ficelles, quant à l'agave " Aga Amaniensis " cette culture nous laisse perplexe, dans une plantation régulière à la Chaumière d'environ 4/5 ans, tous les plants adultes ont fléché en même temps et sont morts. Il est vrai que des bourgeons " Suckers " existent ; mais il faudrait les laisser croître pour obtenir des feuilles, la proportion des plants qui flèchent dans les plantations de Sisal et de Fourcroya est sensiblement inférieure.

Ce que nous devons retenir principalement de la communication de Sir Philippe c'est la demande de " Soft fibre " (le Fourcroya est essentiellement un spécimen de " Soft fibre " dans le groupe des " Hard fibre ".

Quant à la qualité qui laisse fortement à désirer à l'époque, on a voulu sûrement, au Colonial Office, faire allusion aux fibres qui furent expédiées naguère, sans classification aucune. Mais quand l'usine à grader et à presser fut inaugurée, du dire même des acheteurs Européens et Américains la qualité s'était sensiblement améliorée et donnait satisfaction, une classification minutieuse étant faite suivant la longueur et la blancheur des fibres peignées.

L'industrie de la fibre d'aloes a eu pas mal de détracteurs, et malheureusement il s'en est trouvé aussi bien chez nous, qui ont même à un certain moment, voulu admettre l'impossibilité pour nous de pouvoir lutter contre nos concurrents plus à même de tenir le coup, avec les moyens dont ils disposent, principalement les capitaux à bon marché et la grande étendue cultivée par eux — mais avec l'aide gouvernementale, les moyens de transport à bon marché, de bonnes routes de communication et des décortiqueurs automatiques, notre Industrie doit vivre et faire face à toute éventualité.

Les grattes automatiques. Il y en a deux genres qui fonctionnent actuellement, et il y en a deux autres en construction, dont une à la Plaine Lauzun, nous souhaitons que la meilleure soit choisie bientôt et nous donne satisfaction.

Nous disions plus haut que les filateurs se sont sacrifiés parcequ'ils auraient certainement pu obtenir des prix beaucoup plus re nunérateurs en vendant leurs fibres pour l'exportation, ce qui est indéniable ; ils ont permis à la sacherie, par ce fait, de se libérer envers le gouvernement, en réalisant des profits assez substantiels, profits qui somme toute auraient dû revenir aux filateurs, mais comme il a été dit également plus haut, nous voulons bâtir pour l'avenir et nous aimerions voir se solutionner à l'avantage des filateurs la question de la Sacherie Gouvernementale. Nous arrivons à une phase où une décision doit être prise sans tarder, puisqu'il est convenu que le Gouvernement n'a nullement l'intention de continuer à s'en occuper sur une base industrielle, le moment est donc propice pour que le M.H.P.S. s'installe au lieu et place du gouvernement sur une base coopérative.

L'industrie sucrière pourrait-elle aussi produire des fibres en utilisant nombre d'arpents en friche actuellement, et ceux qui s'adonneraient à la production de fibres pourraient former partie du M.H.P.S.

Une filature de nos jours, avec gratte automatique, peut être installée à peu de frais et les fibres pourraient être produites pendant la morte saison.

L'Hon. Bodkin nous a conseillé d'écrire au Gouvernement dans le sens décrit plus haut, et comme d'habitude nous n'aurons reçu qu'un imprimé comme accusé de réception à la lettre que nous avons adressée au Secrétaire Colonial le 24 octobre/46, nous pensons bien faire en la reproduisant :

MAURITIUS HEMP PRODUCERS' SYNDICATE

Port Louis,
24th, October 1946.

The Honourable,
The Colonial Secretary,
Port Louis

Sir,

I am deputed by the Mauritius Hemp Producers' Syndicate to enquire whether Government is now in a position to define its attitude towards Hemp Producers, when the Sack Factory at Quatre Bornes will have fully repaid all sums advanced by Government to the said Factory in respect of Capital and working expenditure since its re-opening in 1941, which repayment, I understand, will have been completed by the end of the current year.

It is a fact that the profits realized by the Sack Factory during the

last five years have provided the means of repaying the above-mentioned advances, and that these profits were only rendered possible by the patriotic co-operation of Mauritius Hemp Producers who contributed to the war effort by supplying fibre at prices which — more often than not — were appreciably less than those which they could have received from abroad during the war period.

It is equally true that the Sugar Industry has benefited by the use of aloe fibre sacks during the years when it was exceedingly difficult — not to say impracticable — to import jute bags from India.

In the expectation of conditions reverting to normal in a comparatively near future, and in view of the remunerative offers that are presently being received from overseas markets, it is evident that the interests of the Mauritius Hemp Producers should henceforth be found in the prompt resumption of their pre-war trade.

On the other hand, it can safely be surmissed that, with the state of things now prevailing in India, no guarantee can be obtained that the entire quantity of jute bags require by our Sugar Industry could be imported therefrom in future, and it may also reasonably be forecast that prices will tend higher with an increased cost of production of the raw material as well as of the finished article, viz. jute bags.

In the circumstances, the question arises whether Hemp Producers would not be well advised to work hand in hand with the Sugar Industry by reserving their entire fibre output for the manufacture of sacks wherein to export the Colony's staple produce, viz. Sugar.

However, before taking such a decision, we should like to know whether Government intends pursuing its policy of substituting itself to normal industrial and commercial interests by maintaining its lien on the Sack Factory, or whether it would be prepared to hand over the said Factory to the Mauritius Hemp Producers' Syndicate for its reorganisation on a co-operative basis, which is the only equitable solution for allowing Hemp Producers to continue to help the Colony whilst reaping the just reward of their efforts.

Such cession would, of course, only take place after complete and final settlement of all accounts due to Government by the Sack Factory. This first step towards reinstating Hemp Producers in their own rights should be followed from a "Development and Welfare" point of view by a combined effort for the eradication of the "Herbe Cordé" pest which is causing grave concern to all small planters and to Aloe estates in particular.

Financial help at the opportune moment and at cheap rates of interest should ultimely contribute to encourage estate owners to extend their plantations in order to gradually reaching the maximum tonnage of fibre required to manufacture the total quantity of sacks needed by the Sugar Industry.

This question of fibre increase is intimately linked up with the adoption by all Hemp Producers of automatic decorticators, and in this line I under-

stand that the " Robey Souchon " machine now being experimented upon is giving entire satisfaction.

However, as no reliable information can be gathered whereon Hemp Producers could from a definite opinion, I would request that some competent authority be appointed by Government to investigate and report on the various types of decorticators in actual use, or in course of experiment, and as already suggested to Government in previous correspondence, I consider that Mr Henri Geneve is the only competent and experienced engineer in fibre machinery to deal with the question.

Furthermore, The Honourable The Director of Agriculture has recently invited the Mauritius Hemp Producers' Syndicate to select four of its Members to collaborate with the Department of Agriculture in the elucidation of a programme of investigation and research on the Fibre Industry, and I presume that the same is to coincide with the arrival of an Expert appointed by Government to report on ways and means to promote the interests of the local Fibre Industry.

Commending the above to His Excellency The Governor's considerate attention,

I have the honour to be
Sir,
Your obedient servant

J. RENE MAINGARD DE VILLE-ÈS-OFFRANS
President,
Mauritius Hemp Producers' Syndicate.

Nous avons eu l'occasion de discuter de la question en plusieurs reprises avec l'Honorable Bodkin avant son départ, mais aucune réponse officielle n'a encore été reçue. Quant au nouveau Directeur de l'Agriculture questionné à ce sujet à une recente réunion des Membres du Comité du G. R. F., il a répondu qu'il n'était pas au courant de la question ! Il est à souhaiter que le bureau colonial prenne cette question en mains et avec l'appui effectif de notre éminent et distingué compatriote Sir Philippe Raffray Kt., C.B.E. K.C. nous avons tout lieu d'espérer pour le mieux.

Puisque nous sommes sur la question de la production des sacs, nous avons également à faire observer que jusqu'ici l'ordonnance qui avait été elaborée—qui devait être déposée sur la table du Conseil depuis 1945—concernant la Sacherie Gouvernementale, l'exonération de la " Poll Tax " pour cette industrie nouvelle et surtout la protection à lui donner en cas de nécessité, est sans doute restée dans les " files " il serait pourtant opportun que toutes ces questions soient solutionnées dans le plus bref délai, on s'est contenté de nommer un comité se composant de deux officiels, deux représentants de l'Industrie Sucrière et deux représentants du M.H.P.S. cela n'est pas suffisant, il faut essentiellement qu'ils y aient des prérogatives sanctionnées par le gouvernement.

Un comité a été également formé de 4 membres du M.H.P.S. et deux membres du staff du Département d'Agriculture pour étudier les possibilités de promouvoir l'industrie textile, on a fait montre de très bonne volonté de part et d'autre, et souhaitons qu'on arrive à des résultats tangibles.

Comme vous le savez un nouveau contrat a été passé avec le G.S.F. pour les fibres à être livrées pendant le cours de cette année ; le prix de l'an dernier a été maintenu, aux mêmes conditions, en ce qui concerne la classification etc. quant a la quantité qui a été évaluée à près de 1000 tonnes, les filateurs sont laissés libres de fournir le plus de fibres possibles, il est à souhaiter que nous nous rendions tous compte de l'intérêt qu'il y a pour nous d'alimenter régulièrement l'usine des Quatre Bornes, le plan actuel pourrait permettre de tisser 1,200,000 sacs sans compter les toiles à filtre-presse, fils embobinés &c, il est donc un devoir impérieux pour chaque filateur d'intensifier sa production.

Nous avons vu avec peine l'Honorable Tristan Mallac, qui a agi comme Vice-Président du M.H.P.S. s'éloigner de nous, n'ayant plus d'intérêt direct dans l'Industrie de la fibre, pour la même raison l'Honorable Pierre Hugnin et M. Raoul Raffray ont dû démissionner. Nous garderons le meilleur souvenir d'eux et nous nous souviendrons des valeureux services rendus par eux à la seconde Industrie du pays.

Mr. Bodkin, qui avait pris corgé l'an dernier, a été remplacé intérimairement par Mr René Lincoln, qui siégea à notre comité, son passage parmi nous, quoique de courte durée, nous a laissé la meilleure impression.

Nous rendons hommage à Mr Bodkin pour l'aide qu'il a voulu donner à l'Industrie Textile ; animé des meilleures intentions, il a fait ce qu'il a pu ; mais malheureusement ses efforts n'ont pas reçu tout l'appui désiré en haut lieu, il va jouir d'un congé et nous reviendra bientôt comme directeur des Banques Co-opératives, il a été remplacé par Mr Craig, à qui nous avons souhaité la bienvenue, lors de la dernière réunion des Membres du Comité.

Nous comptons trois nouveaux membres du comité : MM. Léon Maurel, Philippe Daruty de Grandpré, et Eugène de Ravel en remplacement des membres démissionnaires.

A tous, j'adresse nos remercîments pour l'aide efficace qu'ils m'ont toujours accordée et qui facilita la tâche m'incombant. Mes remercîments vont aussi au Secrétaire-Manager qui a bien dirigé les affaires de notre Syndicat.

J. RENE MAINGARD DE VILLE-ES-OFFRANS.
M.H.P.S.

Port Louis, ce 23 Mai 1947.

(*a être annexé au Rapport du M.H.P.S. du* 23 *Mai* 1947).

Port-Louis, le 30 Mai 1947.

MESSIEURS,

Le Rapport qui vous a été soumis, et qui fut adopté à l'Assemblée Générale tenue le Vendredi 23 Mai à la Chambre d'Agriculture, était déjà à l'impression, quand le Secrétaire de la Chambre d'Agriculture me fit aimablement part d'une nouvelle communication de Sir Philippe Raffray, KT., C.B.E., K.C. concernant nos Fibres, et j'ai le plaisir de vous en donner connaissance, en vous demandant d'annexer la Copie qui vous est remise aujourd hui au Rapport pour l'année 1946 :

Extract from letter No. P/14 Received from Sir Philippe Raffray KT. C.B.E. K.C.

Fibre Conference

" As I wrote to you last week, on Tuesday the 29th ult. I was invited to attend a conference at the Colonial Office under the Chairmanship of Mr. Monson for the continuation of the discussion of the Fibre question.

There were present Professor Furlong of the Imperial Institute, Mr. Clay, C.M.G., C.B.E., the Agricultural Adviser to the Colonial Office, Mr. Willis, another officer of the Colonial Office, Mr. Bodkin, our Director of Agriculture and myself.

The conference lasted for about one hour, when the aloe industry of Mauritius was again considered in great detail. The conclusions which were arrived at were :—

1. That in view of the difficulties of supplies of jute bags from India, and the high prices of these bags — conditions which are likely to last for many years to come — attempts should be made to develop the fibre industry in Mauritius.
2. That apart from such advantage, the industry should be developed from an economic point of view, at it would keep in Mauritius all the money now used to purchase bags from abroad.
3. That the immediate object should be to aim at the production of all the bags required for packing the sugar crop of the Colony.
4. That experience has shown that sisal does not produce sufficiently pliable bags.
5. That there is now, moreover, a large demand for fibre of a softer variety than sisal ; the Mauritius Fourcroya Fibre being particularly suitable.
6. That it should be necessary to send both an agricultural and a mechanical expert to Mauritius as soon as possible.

I did not agree with everything that was said to the Conference. I

know, for instance, that in East Africa they are now making excellent bags from sisal.

I have an impression that there exists still the same feeling in official circles that was apparent in 1945 : it is considered undesirable that Mauritius should produce sisal which might be a source of competition to East Africa I think I have succeeded in obtaining that it should not be definitely decided at this stage, that sisal should not be grown in Mauritius, as the intention undoubtedly was.

This will have to be considered in Mauritius by the experts who will visit Mauritius. "

Une fois de plus nous constatons avec plaisir que les Filateurs peuvent compter sur notre éminent compatriote pour défendre leurs intérêts à Londres.

La lettre de Sir Philippe est un grand réconfort pour nous et souhaitons que sous peu, nous arrivera l'expert qui devra nous guider et dont le but ultime sera de développer notre Industrie.

Nous avons appris que l'Hon. Bodkin a pu assister à la Réunion qui eut lieu au Colonial office et nul doute qu'il a pu, avec l'aide efficace de Sir Philippe, donner tous les renseignements concernant notre Industrie, surtout en ce qui concerne la manufacture des sacs avec nos fibres, ayant pendant des années occupé le fauteuil présidentiel du comité de Direction du Government Sack Factory. Et surtout, qu'il recommande comme du reste il l'avait préconisé lui-même avant son départ de Maurice, que la Sacherie soit passée au M.H.P.S. ; aujourd hui que le Gouvernement peut se récupérer de toutes les avances faites au G.S.F. Nous pourrions comme il est dit dans mon Rapport, travailler sur une base co-opérative dans un intérêt commun.

Je dois ajouter qu'une lettre reçue de Sir Philippe concernant l'exposition de Maurice au British Industries Fair, (dont fait mention mon rapport) nous informe que l'exposition a été des plus réussies, et que la Section réservée aux fibres d'aloës a produit la meilleure impression, nos sacs ainsi que les autres articles fabriqués avec nos fibres ont considérablement intéressé et retenu l attention toute spéciale des visiteurs ; voilà un bon point, et nul doute que notre Industrie en profitera dans l'avenir.

Nous sommes heureux de penser que l'exposition qui avait été préparée à Maurice avec beaucoup de soin et comprenant tout ce que Maurice peut produire, obtient actuellement du succès, ce qui fera plaisir aux Membres du Comité d'organisation.

J. René MAINGARD de VILLE-ÈS-OFFRANS,
Président
Mauritius Hemp Producers' Syndicate.

30/5/47.

STATISTIQUES

1°. CLIMATOLOGIE

(a) Pluviométrie (Pouces)

Localités / Mois	Nord							Centre					
	Grand' Baie	Pamplemousses†	Pamplemousses (Normale)	Abercrombie	Abercrombie (Normale)	Ruisseau Rose	Belle Vue Maurel	Beau Bois (Moka)	Helvétia	Réduit	Réduit (Normale)	Curepipe*	Curepipe (Normale)
July 1947	—	1.81	2.93	1.22	1.82	1.73	—	4.29	3.50	2.72	2.75	5.53	8.57
Aug. „	—	1.95	2.59	1.48	1.90	0.99	—	3.57	5.44	3.15	2.47	11.81	7.79

Localités / Mois	Est				Ouest					Sud			
	Centre de Flacq	Camp de Masque	Palmar	G.R.S.E.	Port-Louis	Case Noyale	Beau-Bassin	Beau-Bassin (Normale)	Richelieu	Rose Belle	Riche-en-Eau	Camp Diable	Chemin Grenier
July 1947	2.52	4.70	1.54	0.48	0.81	0.14	1.14	1.39	0.49	4.70	—	4.12	3.47
Aug. „	3.25	6.37	2.24	3.59	0.68	0.35	1.38	1.13	0.50	7.91	—	4.20	6.62

(b) Température °C

Localités	Beau-Bassin		Réduit				Curepipe*		Richelieu	
Mois	Max.	Min.	Max.	Min.	Moy.	Nor.	Max.	Min.	Max.	Min.‡
July 1947	24.6	15.6	21.9	15.8	18.5	18.0	20.2	14.9	25.6	18.7
Aug. „	24.2	14.9	21.0	14.7	17.4	17.9	18.7	14.0	24.6	18.1

(c) Insolation

Réduit		
Mois	Heures de Soleil	Fraction d'insolation
July 1947.	235.4	69.0
Aug. „	235.7	66.7

*Collège Royal. † Jardin Botanique. ‡ Moyennes mensuelles.

2° Revised Forecast of the 1947 Sugar Crop.

The cool weather experienced throughout most of the maturing season has been very favourable to the ripening process up to the present. Temperature was generally below average and rainfall occurred in sufficient quantities to maintain the cane in good physiological condition.

Harvesting is now well under way all over the island, the sucrose content of the cane is above anticipation while tonnages in the field are generally running high.

The total amount of cane to be ground is estimated at 2,750,000 metric tons and exceeds the previous figure forecast in June by 220,000 metric tons. With an adopted average extraction of 12.0 o/o, the total sugar would approximate 330,000 metric tons.

The distribution according to districts and the production of the last five years are set out in the following table :—

(Unit : One thousand metric tons)

Districts	1947 Forecasts		1946	1945	1944	1943	1942
	Revised	Preliminary					
Pamplemousses and Riv. du Rempart	80	71	86.70	41.71	57.60	77.64	73.60
Flacq	49	47	41.29	21.05	29.98	45.74	51.53
Moka	37	36	31.15	15.47	23.97	40.29	40.42
Plaines Wilhems ...	30	28	23.08	10.18	14.85	23.42	23.92
Black River ...	14	15	11.12	6.61	8.47	13.49	15.07
Savanne	56	53	47.39	22.04	33.95	55.71	61.36
Grand Port ..	64	52	50.33	21.99	30.82	54.43	64.98
Total ..	330	302	291.06	139.05	199.64	310.72	330.88

30th September, 1947

A. DE SORNAY,
Statistician.
Dept. of Agric. Mauritius.